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DUFRÉNOY (J.). **La gommose du bois de Châtaignier.** [Gummosis of Chestnut wood.]—*Comptes rendus Soc. de Biol.*, lxxxvi, 7, pp. 371–374, 4 figs., 1922.

The gum deposited in the wood of certain plants as a sequence to parasitic infection may originate in the degeneration of the tyloses. Woods like those of the chestnut, which normally contain tyloses, develop excessive numbers under parasitic stimulation: old chestnuts suddenly destroyed by ink-disease may show the lumina of their vessels completely blocked by more or less gummified tyloses.

Gum may be deposited in the vessels in the absence of tyloses. It is abundant in the wood of the rootlets formed by chestnuts affected with ink-disease, even when these rootlets terminate in luxuriant mycorrhizal growths. Wood exposed by stem or root cankers is especially subject to gummosis, but this wound gummosis is superficial and local, while that of the tyloses is deep and extensive. These two forms of gummosis should be distinguished from that proceeding from the jellification of the middle lamella of the cell membranes.

KUFFERATH (M.). **Bacterium puttemansi Kufferath nov. spec., microbe produisant des taches sur la Tomate (Lycopersicum esculentum) conservée.** [*Bacterium puttemansi* Kufferath nov. spec., a micro-organism producing spots on conserved Tomato (*Lycopersicum esculentum*).]—*Bull. Soc. Roy. Bot. de Belg.*, liv, 2nd ser. 4, pp. 190–194, 1921.

In this paper a disease of pickled tomatoes, which depreciates their value, is described. It causes rounded, yellowish, swollen spots on the surface of the fruit under the skin which is raised in boil-like swellings but is not ruptured. It is caused by a straight or slightly flexuous, non-motile bacterium, 4 to 15 by 1 μ, and with rounded ends. The bacteria may occur singly or in pairs or in more or less elongated chains in which it is difficult to make out the separate individuals. The organism is Gram-positive and

readily stained. No spores have been observed. It is described as a new species to which the name *B. puttemansi*, after the author who first called attention to it, is given.

It is easily isolated and inoculations with pure cultures have demonstrated that it is the cause of the condition described. In culture development is slow and the colonies are small. In bouillon there is a slight whitish deposit but no turbidity or scum. The individual size is reduced in culture (3 to 5 by 0·8 μ) and chains are infrequent.

The point of invasion has been found to be ordinarily at the stalk end of the fruit, where its detachment from the plant produces ruptures in the epidermis. Inoculations by placing suspensions at this point and then immersing the fruit in the pickling fluid gave characteristic spots in from one to two months. The bacteria were found in the liquid in the interior of the fruit. Sound fruit immersed in pickling liquid which had contained diseased fruit became infected. The bacterium maintains its virulence for a considerable length of time in the pickle. Inoculations by piercing the epidermis with a capillary tube containing the bacteria also gave positive results, the controls in all these cases remaining unaffected.

The organism is stated to belong to the group of the lactic acid bacteria.

WELLES (C. G.). **Cercospora leaf spot of Eggplant.**—*Phytopath.*, xii, 2, pp. 61–65, 2 figs., 1922.

Solanum melongena at Los Baños, Philippine Islands, was found to be attacked by a leaf spot disease. At first the spots were chlorotic, then greyish-brown and concentrically marked, and finally a shot-hole condition resulted. The disease is quite different from the leaf spot caused by *Phyllosticta hortorum*.

Eggplants only are known to be attacked. A Siamese variety was less affected than the native Philippine kind. The photosynthetic area of leaves may be reduced by 75 per cent. The fruit was not found to be attacked.

The parasite is described as *Cercospora melongenae* n. sp. Bordeaux mixture was found to hold the disease in check, but did not appear to be commercially profitable.

NICOLOFF (T.) & STEFANOVA (M.). **Die Kohlhernie in ihren Beziehungen zur Wirtspflanze.** [Club-root of Cabbage in its relation to the host plant.]—Reprinted from *Rev. Inst. de recherches agron. en Bulgarie* in *Zentralbl. für Agrikulturchemie*, li, 4, pp. 101–102, 1922.

The senior author has shown in a previous article [1920] that the higher vegetable parasites *Viscum*, *Loranthus*, *Orobanche*, and *Cuscuta*, absorb large quantities of nitrogen, potassium, phosphorus, etc., from the tissues of their hosts. As *Plasmodiophora brassicae* ravaged the cabbage fields round Sofia during 1920 the opportunity was taken to investigate its effects from this standpoint.

The leaves and roots of healthy and diseased plants were examined and striking differences were found between their protein content. While the leaves of healthy plants contained 33·37 per

cent. of protein in their dry substance, the protein content of those from diseased plants was only 28·65 per cent. In the roots a still greater difference, but in the inverse direction, was found, the healthy roots containing 11·19 per cent. of protein and the diseased 32·87 per cent. Phosphorus and potassium were also present in larger quantities in healthy than in diseased leaves, the reverse being the case in the roots.

HEDGES (FLORENCE). **A bacterial wilt of the Bean caused by Bacterium flaccumfaciens nov. sp.**—*Science*, N. S. lv, pp. 433–434, 1922.

Navy beans (*Phaseolus* sp.) in South Dakota were attacked by a bacterial disease. The plants may be killed in the seedling stage after wilting and sometimes showing dull green to reddish-brown discoloration of the stems, or some of the shoots of older plants may die. The wilt of seedlings resembles somewhat the 'systemic disease' ascribed by Burkholder to *Bact. phaseoli*.

The organism was isolated and found to be a rod with polar flagella, measuring 0·66 to 3 by 0·33 to 0·5 μ, producing yellow colonies; it is named *Bact. flaccumfaciens* n. sp. The disease was reproduced by inoculations. Differences between this organism and *Bact. phaseoli* are mentioned.

KROEMER (K.). **Untersuchungen über die Beziehungen zwischen dem Bau der Rebblätter und ihrer Erkrankung durch Plasmopara viticola.** [Inquiry into the connexion between the structure of Vine leaves and their liability to attack by *Plasmopara viticola*.]—*Ber. der höheren staatl. Lehranst. für Wein-, Obst- und Gartenbau zu Geisenheim-am-Rhein*, pp. 75–76, 1921. [Included in *Landw. Jahrb.*, lvi, Suppt. 1, 1921.]

The researches of Müller-Thurgau, Ruhland, and von Faber have indicated that *Plasmopara* infection is dependent on the distribution of the stomata, and therefore occurs as a rule through the under side of the leaf. A relation has also been established between the disease and the age of the leaf, young leaves being more virulently attacked than old ones when artificially inoculated. The youngest leaves of all, however, have completely resisted every attempt at artificial infection.

The author has particularly studied the dentate margin of the leaves and the development of the stomata and epidermal tissue. Special attention was paid to the structure, distribution, and functions of the water pores, which are situated on the upper side of the leaf teeth. They can only be clearly distinguished in young leaves, since the tissues of the leaf margin shrivel up completely with age. An exudate of water from these pores may be observed after cool nights in May and June.

The author concludes as a result of numerous observations on leaves from different localities that infection by *Plasmopara* takes place principally through the water pores, which supply the conidia with the necessary moisture for the development of their swarm-spores and enable the germ-tubes of the latter to penetrate the interior of the leaf.

HIGGINS (B. B.). **Notes on the morphology and systematic relationship of Sclerotium rolfsii Sacc.**—*Journ. Elisha Mitchell Sci. Soc.*, xxxvii, 3–4, pp. 167–172, 1 pl., 1922.

Investigations undertaken with a view to discovering a fruiting stage of *Sclerotium rolfsii*, which occurs very generally in the warmer parts of the United States, have failed. On fleshy plants, and such fruits as cantaloupe, the growth of this fungus is very vigorous and characteristic; the mycelium forms broad, white sheets and a number of sclerotia develop. On small or more woody stems, however, such as sweet potato slips or pepper plants, the growth is often scanty and indistinguishable macroscopically from several other fungi, and sclerotia often fail to develop even in a moist chamber.

The mycelium is rather coarse, with large cells (150 to 250 by 2 to 9 μ), the feeding branches being more slender (about 2 μ in diameter). Clamp-connexions occur in the broader threads, and branching may take place behind the cross wall. In the slender threads branches may arise from any point. The clamp-connexions often develop abnormally, giving the impression of budding of the mycelium (cf. Taubenhaus, *Journ. Agric. Res.*, xviii, p. 127, 1919). The branches often anastomose and hold the hyphae together in sheets or strands. The cells of the mycelium are binucleate.

The sclerotia first appear as small, white tufts of loosely intertwined branches, with an actively growing region near the periphery. The latter is about one-twentieth of a millimetre thick, rich in protoplasm, and more readily stained than the centre of the mass. Within twenty-four to forty-eight hours all the cells of the mass, except those of the downy covering surrounding the growing region, swell to about three times their former size and become vacuolate and usually multinucleate. The cell walls of the growing region coalesce and gelatinize, forming a pseudoparenchymatous tissue about one-seventh of a millimetre thick. The cells of an outer layer lose their protoplasm and the walls collapse, a corky covering being thus formed over the surface of the mature sclerotium. The outer downy covering sloughs off, leaving the surface dark brown, smooth, and shiny. The cells of the pseudoparenchyma are broad, hyaline, and without air spaces, in contrast to those of the centre of the sclerotium. The mature sclerotia are dark brown, globose to elliptical, and 0·5 to 1·5 mm. in diameter.

Several sclerotia of an old culture originating from a wilted pepper plant were planted on agar plates, and fifty filaments isolated and planted. Five only survived and produced new growth. These were transferred to tubes of steamed bean pods, and in a few days produced abundant sclerotia. Transfers were then planted on plates of peptone beef extract agar—three colonies to each plate, two of *A* and one of *B*, etc., throughout the series. The production of sclerotia in these plates was rather irregular, but no sign of 'mixing' was observed. This experiment does not prove the non-existence of plus and minus strains (suggested by Taubenhaus, *loc. cit.*), but it shows that the mixture of such strains is not essential to the production of sclerotia.

Mature sclerotia placed in contact with a suitable medium send out hyphae from all over their surfaces without any apparent break

in the tissue. The new hyphae are slender and push or dissolve an opening between the cells of the compact outer tissues: their cells are binucleate. Kept in a dry place the sclerotia remain viable for a long time (more than two years in one instance). It is not probable that they last long under field conditions, being very susceptible to freezing when wet.

The presence of clamp-connexions and of the binucleate cells shows the fungus to be related to the Basidiomycetes. These characteristics, together with the formation of sclerotia, are common to nearly all families of Basidiomycetes, and it does not seem possible to determine any closer relationship until spore formation has been observed.

La Rue (C. D.) & Bartlett (H. H.). **A demonstration of numerous distinct strains within the nominal species Pestalozzia guepini Desm.**—*Amer. Journ. of Bot.*, ix, 2, pp. 79–92, 1922.

A comparison of several strains of *Pestalozzia* isolated from diseased tissues of *Hevea brasiliensis* in Sumatra showed that while all, broadly speaking, fell within the limits of *Pestalozzia guepini* Desm., they were quantitatively different in regard to spore measurements and maintained their distinct characteristics through successive generations. Only morphological criteria are available in weakly parasitic genera, the members of which are not confined to specific or closely related hosts, and in such cases the authors think that morphologically indistinguishable fungi, not known to be confined to particular hosts, should be called by the same name, though the strains may show a wide range of variations among themselves.

Apparently all the common diseases of Pará rubber in the East are due to more or less ubiquitous fungi, and generally speaking the forms pathogenic to *Hevea* are known to infect the most diverse cultivated plants. *Pestalozzia* is familiar in the East mainly as the cause of grey blight of tea and leaf spot of coco-nut. The name *P. guepini* was originally applied to a form isolated from camellia and magnolia, characterized by a spore length of about one-fiftieth millimetre, with 4-septate spores, the terminal and basal cells hyaline and the three interior cells dark; appendages longer than the spores and typically three in number.

More recently tea blight and a stem disease of rubber seedlings, *inter alia*, have been attributed to *P. palmarum* Cke. Apart from an irreconcilable discrepancy in the measurements, the latter fungus does not differ materially from *P. guepini*. Sawada's creation of the new species *P. theae* for the form on tea is not accepted by the authors, since according to them the fungus does not differ sufficiently from *P. guepini* to warrant the creation of a fresh species. An examination of the literature on *Pestalozzia* diseases shows that, in general, authors have preferred to use the name *P. guepini* for tea diseases and *P. palmarum* for those of the palm, but the usage has not been justified either by cross-inoculation studies or the discovery of reliable morphological distinctions.

The writers' experiments involved comparisons between thirty-five strains—twenty-two from rubber, seven from coco-nut, three from tea, two from oil palm, and one from areca palm. The

strains were measured through from four to eight successive generations, spore production taking twice as long in some cases as in others. The cultures were all grown on *Hevea* leaf agar with native brown sugar, no attempt being made at maintaining a constant temperature. The physiological differences shown by the strains among themselves were not correlated with morphological characters.

A rough analysis shows that the thirty-five strains fall into fourteen groups, as judged by a statistical examination of a series of measurements of spores and appendages, and that these groups are not confined to particular hosts.

TANAKA (T.). **Japanese fungi.—Notes and translations, XI.**—*Mycologia*, xiv, pp. 81–89, 1922.

The author continues his series of technical diagnoses in English of a number of important parasitic fungi from Japan which have previously only been described in Japanese. In each case, besides the technical description, references are given to the Japanese literature and figures, and there are critical notes in many instances.

Helminthosporium oryzae Miyabe and Hori [*Bull. Agric. Exper. Stat. Nishigahara*, No. 18, pp. 67–84, 1901] has been treated in western countries as a *nomen nudum*, as the original description, and also Hori's later emendation (*Discourse on diseases of agricultural crops*, pp. 106–107, 1911) were in Japanese. It causes scattered or grouped, fuliginous or soot-coloured, velvety spots on the culms, leaves, and glumes of rice. The conidiophores are grouped two or three together, brownish, 100–330 by 7·2 μ, more or less bent, 7- to 15-septate, the lowermost cells largest and rather rounded and swollen, the width of the cells gradually reduced towards the apex, terminated by a blunt, thin-walled, light coloured or almost colourless cell. The conidia are 6- to 11-septate, fuscous, lunate or obclavate, bending to one side, obtuse at the ends, only slightly constricted at the septa, 84 to 140 by 16 to 22 μ. They germinate by germ-tubes from both ends. Both swamp and upland rice are affected. The spots on the leaf are at first small, then elongated and coalesced. Discoloration and withering of the leaf from the tip backwards soon follows, often causing the death of the whole plant. Hara in 1918 stated that this may be identical with Breda de Haan's *Helminthosporium oryzae* [*Bull. Inst. Bot. Buitenzorg*, vi, p. 11, 1900], though the description of the latter is rather imperfect. It differs strikingly from *H. macrocarpum* Grev. in the shape of the conidia. Recently, prevention through seed treatment and spraying with various fungicides has proved effective in Japan.

Glomerella cinnamomi Yoshino [*Bot. Mag. Tokyo*, xxi, pp. 230–232, 1907 (Japanese)] causes a serious disease of camphor trees, especially in nursery plants and young plantations in Formosa. The Formosan fungus generally agrees with that described from Kyûshiû by Yoshino, with the exception of the smaller size of the ascospores. Hara (*Bot. Mag. Tokyo*, xxvii, p. 272) suggests that the present species should be called *Guignardia cinnamomi* on account of the lack of the stroma characteristic of *Glomerella*.

Physoderma maydis Miyabe [in A. Ideta, *Handbook of plant diseases of Japan*, 4th ed., Tokyo, p. 114, 1909 (Japanese). Synonyms:

Cladochytrium, sp. nov. K. Sengoku (*Journ. Agric. Soc. Ehime Prefecture*, xxxii, p. 58, 1901): *Cladochytrium maydis* Miyabe (in A. Ideta, *Handbook of plant diseases of Japan*, 3rd ed., Tokyo, p. 75, *nomen nudum*; J. Ômori and G. Yamada, *Plant Pathology*, p. 202, 1904, *nomen nudum*)] causes numerous orbicular, elliptical, or linear spots on the culm, midrib of leaves, and lower part of the husk of *Zea mays*; the spots are mostly small, often confluent, brown or fuliginous, light coloured near the margin. Sporangia are ellipsoid-ovate or globose, deep brown, 24 to 26 μ by 22 to 24 μ. The disease does not usually prevent fruiting, but sometimes does so when it occurs abundantly in the early stage of growth of the host plant. It is not known to occur in Japanese territory outside the prefecture of Ehime, Shikoku Island. This fungus is, in many respects, identical with *Physoderma zeae-maydis* Shaw, first reported from India (*Ann. mycologici*, x, pp. 245–247, 1912), though no actual comparison of the organisms has yet been carried out; the latter is now known to be responsible for one of the worst diseases of maize in the United States, and plant quarantine against this fungus was decreed by the United States Department of Agriculture in 1916.

Colletotrichum boehmeriae K. Sawada [*Journ. Formosan Nat. Hist. Soc.*, No. 17, p. 2, 1914 (Japanese)], occurs on the leaves and on the stem of ramie (*Boehmeria nivea*); on the former the spots are scattered, cinereous, with a brown margin, orbicular, and 1 to 2 mm. in diameter; on the stem they are orbicular, elliptical, or fusiform, occasionally causing longitudinal ruptures of the host epidermis, and 1 to 6 by 0·8 to 2 mm. in size. The hyphae are colourless, 4 μ thick; acervuli small, with setae; conidiophores dense and short; conidia colourless, cylindrical, or occasionally clavate, straight, obtuse at ends, granular, 14 to 19 by 4 to 5 μ; setae dark brown, tapering towards the apex, 1- to 2-septate, 45 to 85 by 4 to 5 μ. The stem infection produces a bad staining of the bast fibres which can hardly be removed by bleaching.

Cercospora piricola K. Sawada [*Journ. Formosan Nat. Hist. Soc.*, No. 17, p. 3, 1914 (Japanese)], on *Pyrus communis* and *sinensis*, hypophyllous; the spots usually are 1 to 3 mm. in diameter, angular, occupying a definite area enclosed by veinlets; later they coalesce and often cover the entire surface of the leaf; colour cinereous, later changing to brown. The conidiophores are fascicled, several (ten or more) together, straight or curved, cinereous, 0- to 2-septate, and 15 to 27 by 3 to 4 μ; conidia linear, curved, 3- to 5-septate, greyish and almost colourless, and 28 to 57 by 2·5 to 3·5 μ. This fungus resembles *Cercospora minima* Tracy & Earle (*Bull. Torr. Bot. Club*, xxiii, p. 206, 1896) on pear from America, but differs in being hypopyhllous and in having longer conidiophores and shorter but thicker conidia of greyish colour. The extent of the injury caused by it is not known.

Detailed descriptions are also given of the following fungi: *Mycosphaerella bambusifolia* Miyake and Hara sp. nov. [*Bot. Mag. Tokyo*, xxiv, pp. 338–40, 1910 (Japanese)]; *Phaeosphaeria bambusae* Miyake and Hara sp. nov. [ibid., pp. 340–341]; *Ustilaginoidea sacchari-narengae* K. Sawada sp. nov. [*Journ. Formosan Nat. Hist. Soc.*, iv, pp. 4–5, 1914 (Japanese)]; *Plasmopara wildemaniana*

P. Henn. var. *macrospora* K. Sawada var. nov. [ibid., xvi, pp. 2–4, 1914 (Japanese)] and *Ustilago formosana* K. Sawada sp. nov. [ibid., xxxiv, pp. 6–8, 1918 (Japanese)].

RAMIREZ (R.). **Cyathus de la Vid.** [*Cyathus* on the Vine.]—*La Revista Agricola* [Mexico], v, 10, p. 720, 1 fig., 1921.

In 1919, a vine growing in the field attached to the chief agricultural station was invaded by a rare organism. The runners were covered with white, branched, and sometimes reticulated filaments, while on or near the nodes of the branches whitish bodies (which later turned brown) arose. These, on development, opened out at the free end and took on the form of trumpets, in the interior of which four dark tubercles were visible, resembling seeds, each held by a thin cord. These characters and the microscopical details enabled the author to identify the parasite as a species of *Cyathus*.

To check the disease the author recommends prompt incineration of the affected parts, followed by spraying with Bordeaux mixture.

GARD (M.). **L'apoplexie de la Vigne et les formes résupinées du Fomes igniarius.** [Apoplexy of the Vine and resupinate forms of *Fomes igniarius*.]—*Bull. Soc. de Path. Vég. de France*, ix, 1, pp. 22–28, 2 figs., 1922.

The term 'apoplexy' is applied to the sudden drying up of a vine in full growth which cannot be attributed to drought since it occurs with equal frequence in damp soil and during rainy seasons. An examination of affected vines shows that the wood is transformed into a soft, spongy mass, containing an abundant mycelium such as is characteristic of the Polyporaceae. The wine-growers of Smyrna have named this spongy wood 'iska', meaning tinder.

Pure cultures were obtained by Viala from this diseased wood, and fructifications from these were identified by Mangin and Patouillard as *Fomes igniarius*. The author has found resupinate fructifications on diseased vines and has compared them with other resupinate forms of *F. igniarius* on oak, acacia, and several kinds of fruit tree. On these hosts the sporophore bears numerous cystidia, but the latter were practically absent in the forms occurring on vines in the south-west of France. This scarcity of cystidia results in a different surface texture as compared with the ordinary forms, in which the surface is somewhat velvety. The form on the vine is also pale in colour. The author accordingly creates a new variety, *viticidus*, a diagnosis of which is given.

The mycelium extends beyond the spongy wood into that which appears normal. It has been found in two-year old branches and even in those of the current year. Probably grafts obtained from affected vines often bear within them the germ of the disease.

Infection is said to take place through large wounds such as those caused in pruning. The fructifications have been observed on vines in the Gironde, Charente, and Lot-et-Garonne. Often, however, their development is arrested, and they form only a yellow, downy mass. It is believed that growth of the parasite in infected wood continues during the winter. The symptoms are

said to be due to obstruction of the vessels not only by hyphae but also by tyloses and wound gum.

[In the discussion on this paper (*loc. cit.*, pp. 18–19) Patouillard stated that he had found cystidia in normal quantities on a specimen received from Gard, and it would, therefore, appear that it is not a distinct variety of *F. igniarius*. Viala stated that the fungus is very susceptible to the action of arsenious acid, and the latter has been used in practice for its control for a number of years. *Stereum hirsutum* can also cause a form of apoplexy of the vine. *F. igniarius* is a vigorous destroyer of tannin by means of an oxydase which is excreted by the mycelium growing in the dead wood and acts on the tissues in advance of its growth. Active growth only occurs in tissues rich in tannin, and the attack occurs usually on vines after they are about fifteen years old, before which treatment with arsenious acid is not usually required. The disease is very common in parts of Italy, where it is known as 'esca' from the old Greek 'iska'. This is a preferable name to apoplexy. Similar effects are produced in olive trees, which are frequently attacked by *F. igniarius*.]

HENNING (E.). **Avdelning för landtbruks botanik.** [Division of Agricultural Botany.]—*Årsberättelse över verksamheten vid Centralanstalten för försöksväsendet på jordbruksområdet under år 1921.* Reprinted from *Kungl. Landtbruks-Akad. Handl. och Tidsk., år 1922*, pp. 26–32, 1922.

Immunity trials with various crops were continued at the Swedish Central Agricultural Research Station in 1921. Nearly all the autumn wheats were very susceptible to yellow rust [*Puccinia glumarum*]. Pansar, Svea, and Thule II, suffered somewhat less than the other varieties. The early American variety, Michigan Bronze, was as usual the most susceptible. Mildew [*Erysiphe graminis*] was very prevalent, especially in too closely sown crops; Pansar was again comparatively resistant.

Experiments with various fungicides in the control of smut and the snow fungus [*Fusarium nivale*] gave satisfactory results in the case of formalin and uspulun. Formalin also effectively controlled gooseberry mildew, one treatment in the early spring considerably reducing the incidence of the disease.

Grey speck disease of oats, generally associated with excessively alkaline soils, was reported from a number of localities in all parts of the country. Yellow tip disease occurred in Östergötland and Småland on oats and in West Bothnia on timothy. Chlorine gas from an electro-chemical factory was responsible for severe smoke injuries to crops in the vicinity. Bunt of wheat [*Tilletia tritici*] was widespread and virulent, and many complaints were received that seed treatment with copper sulphate or formalin was not effective. These were in all probability cases of after-infection from the floor, sacks, sowing implements, or the workers' shoes. Immersion is always preferable to sprinkling as being both cheaper and more reliable. Loose and covered smuts [*Ustilago nuda* and *U. hordei*] were both prevalent on barley. Severe damage from black rust [*Puccinia graminis*] occurred on late-sown seed in humus-rich soils and in low-lying, richly-fertilized fields. Yellow rust caused

severe damage to wheat in South and Central Sweden, especially to the native varieties. Svea and Thule II exhibited a high degree of resistance, but Pansar was severely attacked. In some districts barley also suffered considerably from yellow rust. Mildew occurred on both wheat and barley, while ergot [*Claviceps purpurea*] was also prevalent on the latter. Stripe disease [*Helminthosporium gramineum*] was present in Värmland, on Primus, Yellow, and six-rowed barleys. The strawbreaker fungus [*Leptosphaeria herpotrichoides*] severely damaged wheat and rye in low-lying districts. Straw fusariose occurred on early-sown rye.

In the northern districts much damage was caused by *Phytophthora* on potatoes. Severe attacks of corky scab (*Spongospora*) were reported from a number of districts. Wilt due to *Verticillium* and stalk bacteriosis were also reported. Ordinary scab [*Actinomyces scabies*] was prevalent in South Värmland, especially on Up-to-Date. Club-root (*Plasmodiophora*) and brown bacteriosis occurred on cabbage, root blight (*Pythium*) and heart-rot (*Phoma betae*) on beet. A severe disease of lucerne in 1920, caused by a species of *Macrosporium*, appeared to have been eradicated by sanitary measures.

Apple mildew (*Podosphaera leucotricha*), *Monilia* (especially on the Signe Tillisch variety of apple), gooseberry mildew (*Sphaerotheca mors-uvae*), and currant rust (*Puccinia ribis*) were all very prevalent. A speckling of apples, thought to be due to climatic conditions, occurred on the varieties Gravenstein, Ribston, and Signe Tillisch.

Wart disease of potatoes (*Synchytrium endobioticum*) no longer occurs in Sweden, but there is considerable danger that it may be introduced with consignments of potatoes from foreign countries. In conjunction with the General Agricultural Society of Sweden, the Botanical Division of the Central Institute obtained the passage of legislative measures concerning the import of potatoes [see this *Review*, i, 4, p. 128]. In order to conform to the regulations concerning the export of potatoes to certain foreign countries, twelve inspectors have been specially trained to examine the consignments before dispatch from the various ports.

WELLES (C. G.). **Bacterial plant diseases in the Philippine Islands.**—*Science*, N.S. lvi, p. 18, 1922.

While fungous diseases of plants are common in the Philippines, bacterial diseases of plants have been found to be rare, at least in central and southern Luzon. The only bacterial diseases so far found there are *Bacterium solanacearum* on various plants, citrus canker [*Pseudomonas citri*], *Pseudomonas campestris* on cabbage, *Ps. phaseoli* on beans, *Ps. malvacearum* on cotton, and an undescribed organism on parsley. With the possible exceptions of the citrus canker and parsley disease, the organisms and hosts are not indigenous to the Philippines.

HEDGES (FLORENCE). **Bacterial pustule of Soy Bean.**—*Science*, N.S. lvi, pp. 111-112, 1922.

A leaf spot of soy-bean which differs in the earlier stages of attack from the disease caused by *Bacterium glycineum* Coerper,

is noted from Washington, D.C., southwards. The spots show a slight raising of the centre of the area in young infections, whence the name 'pustule'. Water-soaking is not produced, and in later stages the spots become characteristically reddish-brown and angular.

The organism gives a yellow growth and resembles *Bacterium phaseoli* E. F. Smith, but though it will cause infection on *Phaseolus*, *B. phaseoli* from the latter will not normally infect soy-bean. There are also slight differences in growth characters between colonies of *B. phaseoli* and the organism from the soy-bean. The latter is therefore named *B. phaseoli* var. *sojense* n. var.

MANZONI (L.). **Una causa bacterica dell' incappucciamento del Trifoglio pratense.** [A bacterial cause of leaf curl of *Trifolium pratense*.]—*Le Staz. Sperim. Agrarie Ital.*, lv, 4–6, pp. 136–144, 2 pl., 1922.

In this paper the author describes a leaf curl ('incappucciamento') of clover (*Trifolium pratense*) observed in a field belonging to the Royal College of Viticulture and Oenology at Conegliano, Italy. The characteristic feature of the disease in the aerial portion of the plant is the formation of a large number of thin, short branches growing close together and bent inwards, covered with slightly deformed leaflets three or four times smaller than normal, the laminae of which are folded on the midrib. The affected plants are always of a lighter green than normal, the condition resembling chlorosis. There are apparently many gradations in the intensity of the disease between perfect health and full attack. The root system of all infected plants examined was free from any marks of insect injury, but an important pathological modification was found in the woody cylinder of the principal tap root. The centre of the disturbance is usually in the vicinity of the collar, not infrequently just below it, and it extends downwards in gradually diminishing intensity for a considerable distance, even involving some of the principal lateral roots. In this diseased area the affected tissues turn a dark brown colour, shading towards black. The discoloration is continuous in the region of maximum disturbance, but in the more distant parts becomes broken up into small brown patches in the healthy wood. It is due to narrow, brown strands running downwards in the woody bundles, and also, but only when the centre of infection is not immediately below the collar, extending upwards. Affected wood vessels are generally obstructed by dense masses of a dark brown or black substance, their walls being vivid yellow in colour. The wood fibres and parenchyma are similarly affected, their contents being also frequently brown. The cells surrounding these areas undergo an abnormal development, dividing in a plane tangential to the centre of the disturbance, so that the diseased areas are isolated from the remaining xylem by new tissues, which have the aspect of a secondary meristem. This process is not invariably clearly marked, and affected plants which lack the ring of protective tissue may be found occasionally. It is difficult to give a reason for this difference in behaviour, unless it may be due to the age of the vessels and cells at the moment of the initial attack.

In very thin sections (under 15 μ) it is possible to distinguish, even without staining, alongside the wood vessels filled with the dark brown, homogeneous, limpid, almost transparent substance already referred to, others, generally less numerous, the contents of which are of a slightly lighter colour, but opaque and finely granulated, resembling bacterial zoogloeae. The author was able to examine a vessel in which the isolated granulations could be distinguished, and their aspect and form was that of true bacteria. Technical difficulties prevented a satisfactory photo-micrograph being taken, but typical vessels containing these granulations are figured, and given side by side with a photo-micrograph (medium enlargement) of the section from which the drawing was made.

Methylene blue in borax was found to be the most effective stain for the bacteria in the vessels, acting in even very dilute solutions if left for two or more hours. Carbol-fuchsin and gentian violet also stained them satisfactorily, though the outline was somewhat less distinct. The bacteria are usually elongated, sometimes slightly elliptical, and measure 1 to 2 by $\frac{1}{2}\,\mu$. They are often in pairs joined end to end.

Pure cultures of these bacteria were obtained. On a medium composed of clover root extract, meat extract, saccharose, and agar the colonies were visible after 24 hours, and after 48 hours their development was very distinct. Their aspect was always the same: the superficial colonies were circular, glossy, watery, slightly raised, colourless at the borders, whitish and mother-of-pearl-like at the centre, and 2 to 5 mm. in diameter; the submerged ones were spheroidal or lenticular, greyish-white, and 1 or 2 millimetres in diameter. In old cultures the agar below the colonies darkened as if a brown pigment had been excreted. The colonies consisted of elliptical bacteria, generally isolated, measuring 1 to $2\frac{1}{2}$ by $\frac{1}{2}$ or rarely 1 μ and taking all the ordinary stains. Inoculation experiments are described which reproduced the alterations in the wood vessels of the root already mentioned, including the formation of bacterial zooglocae, but the aerial symptoms had not become visible at the time the plants were pulled for examination, though the tops appeared somewhat less vigorous and paler than those of the controls. Possibly enough time was not given for the full development of the disease.

Though the author admits that his experiments have not proved the organism isolated to be the immediate cause of the leaf curl disease in clover, he thinks that the bacterial growth in the root system gradually brings about the death of the plant, which only develops leaf curl in the last period of its life, possibly in only a small number of cases and under special soil conditions. He believes that the growth of innumerable thin branches observed on diseased plants may represent their last effort at resistance, an effort which may or may not be made, according to circumstances. These opinions are based on the facts that the actual loss of clover plants in the field under observation was much more extensive than would be expected from the amount of leaf curl present, and that many plants without leaf curl were found to be suffering from the bacterial root disease. It is thought that infection occurs through wounds.

Lyspletsyge hos Havre. [Bright speck disease of Oats.]—*Statens Forsøgsvirksomhed i Plantekultur. Medd.* 94, 2 pp., 2 figs., 1922.

'Bright speck' disease of oats in Denmark, which occasionally is found also on other cereals, beetroot, potatoes, &c., is most conspicuous about the middle of June, when large, withered spots appear on the leaves. The affected leaves often bend sharply in the middle or at the base and hang down limply. In severe cases the crop is practically destroyed, and in any case the affected plants seldom recover full vigour.

This diseased condition is said to be due to unsuitable soil conditions, being found principally on soils containing a superfluity of humus (reclaimed swamps and the like), an excess of lime or marl, or ashes and building refuse. Such soils generally have a high degree of alkalinity, and the 'bright speck' is found year after year on them.

The disease may be controlled by the application of manganese sulphate at the rate of 5 gm. per sq. metre (50 kg. per hectare). This should be strewn in the early spring over the places where the disease habitually occurs, adding sand, when necessary, to ensure even distribution. In the case of later applications, 1 kg. of manganese sulphate should be dissolved in 10 kg. of water and sprayed over the plants. Certain varieties of oats, e.g. Grey and Moss, are resistant and can be grown with advantage. Acid fertilizers, such as sulphate of ammonia, superphosphate, and kainit are preferable to Chile saltpetre, basic slag, 37 per cent. potash, or organic manure. The use of lime and marl should be avoided.

LINDFORS (T.). **Erfarenheter från vintern 1921–22 beträffande betning mot snömögel.** [Experience of the winter 1921–22 as regards disinfection against the snow fungus.]—*Centralanst. för Jordbruksförsök. Circ.* 80, 7 pp., 1922.

During the winter of 1921–22 the damage caused by the snow fungus [*Fusarium nivale*] was unusually severe in Sweden, especially on rye. In previous pamphlets the Central Institute recommended the use of mercurial preparations, e.g. uspulun and corrosive sublimate, as disinfectants for the seed, and the reports of the results obtained in forty-two different localities, chiefly with rye, as wheat is only exceptionally attacked, can be summarized as follows:—In the great majority of cases the disease was completely held in check by the treatment (generally uspulun). The few failures were probably due to the substitution of sprinkling for immersion, so that infected light seed was sown, or the susceptibility to frost of the particular varieties of rye selected for planting. The complete eradication of infection can only be ensured by immersion, since the parasite is carried on the seed.

In an experiment conducted by the author it was found that 22·1 per cent. of untreated plants, 50·4 per cent. of plants treated with uspulun, and 57·7 per cent. of those disinfected with sublimate survived the winter. It was ascertained in the course of the experiment that the same solution can be used repeatedly (up to eight times) without reducing its efficacy.

STAPLEDON (R. G.), WILLIAMS (R. D.), SAMPSON (KATHLEEN), & JENKIN (T. J.). **Preliminary investigations with herbage plants.**—*Bull. Welsh Plant Breeding Stat. Aberystwyth.* Ser. 4. No. 1, 1922.

A general review of the incidence of fungous diseases on the wide range of grasses and forage crops grown at the Station in the seasons 1919 to 1921 is contributed by Miss Sampson. Thirty-four species of fungi are recorded, twenty-five on Gramineae and nine on Leguminosae. These include several rare forms and three species—*Septoria culmifida* on *Alopecurus pratensis*, *Poa trivialis*, *Dactylis glomerata*, *Phleum pratense*, and *Arrhenatherum avenaceum*; *Mycosphaerella carinthiaca* on *Trifolium pratense* (English Broad Red), and *Sphaerulina trifolii* on *Trifolium repens*—that are new for the British flora.

The abundance of parasitic fungi in the plots is correlated with the methods of growing the hosts in pure species. At least two, *Gloeosporium caulivorum* and *Puccinia phlei-pratense*, are noted as causing an appreciable amount of damage. The former caused much damage to the clovers in the wet season of 1920 and a separate section of the bulletin, written by Miss Sampson, is devoted to a short account of it. *Trifolium pratense* is by far the most susceptible host, but successful inoculations were obtained on *T. repens*, *T. suaveolens*, and *T. hybridum*. Inoculations on *T. medium*, *T. incarnatum*, *Medicago lupulina*, and *M. sativa* failed. *Pseudopeziza trifolii* also caused appreciable injury to *Trifolium pratense* and *Erysiphe polygoni* and some to *T. incarnatum*. Of the twelve grass rusts, recorded, *Puccinia phlei-pratense* was severe in 1920–21 on *Phleum pratense*, some strains being considerably more susceptible than others. In the same seasons *P. glumarum* caused injury to *Dactylis glomerata*, *P. lolii* and *P. dispersa* to *Lolium perenne* and other rye grasses, and *P. perplexans* to the aftermath of *Alopecurus pratensis*. *Mastigosporium album* was particularly severe on the last-named host in late autumn and early spring, especially on introduced commercial seed. *A. nigricans* was also badly attacked by this fungus.

The incidence of the various fungi is recorded in detail under each group of host plants by Miss Sampson.

MCFARLAND (F. T.). **Factors affecting the germination of the sclerotia of Claviceps (Ergot of Rye).**—Abs. in *Science*, N.S. lvi, p. 85, 1922.

Sclerotia of ergot [*Claviceps purpurea*] more than a year old failed to germinate. Sclerotia sown out of doors on the surface of the soil without covering germinated well, but the stalks were usually short. The sclerotia must go through a period of rest, the shortest so far found being eight weeks during which they were kept in moist sand. Removal of the cuticle of the sclerotia, or treatment of them with 5 per cent. or 30 per cent. NaCl solution followed by washing, did not prevent germination.

BONNS (W. W.). **A preliminary study of Claviceps purpurea in culture.**—*Amer. Journ. of Bot.*, ix, 7, pp. 339–353, 6 pl., 1922.

The characters of a series of cultures started in 1919 by the

author with a view to ascertaining whether by growing *Claviceps purpurea* on artificial media the physiological principles extracted from the natural sclerotia of the fungus could be obtained, confirmed in great part the descriptions and observations of Brefeld, Meyer, and Engelke. Unlike them, however, he was successful in obtaining a stage, in cultures of advanced age, which distinctly resembled the pseudoparenchyma and epidermal layers of the natural sclerotium. He demonstrated also the development of the conidial stage directly from the sclerotium without germination of the latter and without the formation of ascospores.

In the light of tests made with extracts of the cultures, the best being those grown on corn meal, there is reason to believe that only one of the commonly recognized active principles of ergot, namely histamine, was present. Ergotoxin was apparently absent, but chemical analyses on a larger scale than those made are necessary before this fact can be established with certainty. The author believes, however, that very probably the presence of this alkaloid is directly associated with changes involving sclerotial formation, a stage not obtained in his cultures. He concludes that it is extremely doubtful whether the artificial cultivation of *Claviceps purpurea* possesses any practical application.

DUCELLIER (L.). **L'ergot de l'Avoine** [Ergot of Oats.]—*Bull. Soc. Hist. Nat. Afrique du Nord*, xiii, 4, pp. 98–99, 1922.

Claviceps purpurea is found in Algeria on many wild grasses, such as *Ampelodesmos*, *Festuca*, *Lolium*, &c., but amongst cultivated cereals it has so far only been observed on oats. Rye, which is grown here and there in Algeria and Morocco, appears to be free from the disease, though the seed has been imported from localities in Europe and America where ergot of rye is common.

Since 1886, when the parasite was reported to be very prevalent on oats grown in the Mekerra valley, *Claviceps* has been frequently observed on this cereal in several regions of Algeria. The most commonly affected variety is *Avena algeriensis* Trab. ('red and black oats of Algeria') but *A. sativa* L. and *A. fatua* L. var. *glabrescens* Coss. are also subject to the disease. The susceptibility of *A. sterilis* L. and *A. barbata* Brot. is being investigated. No ergot has hitherto been found on wheat, though affected oats have been found on several occasions growing amongst hard wheats in Algeria.

TANRET (G.). **L'ergot d'Avoine et l'ergot de Diss.** [Ergot of Oats and ergot of 'Diss' grass.]—*Bull. Agric. Algérie-Tunisie-Maroc*, 2nd Ser., xxviii, 4, pp. 108–109, 1922.

The author reports the results of an examination of *Claviceps purpurea* on the grass locally known as 'diss' in Algeria (*Ampelodesmos tenax*) and on oats, with a view to determining their content of ergotinin, the supplies of which are now scarce owing to the closure of the Russian market.

The ergot of diss grass was found to be relatively weak in crystallizable ergotinin and to contain approximately an equal quantity of amorphous ergotinin (hydroergotinin or ergotoxin), the two together giving only about 0·10 gm. per kg. of ergot.

The ergot from oats was found, on the other hand, to be richer than that ordinarily obtained from rye, containing 0·80 gm. crystallizable ergotinin as against 0·40 to 0·60 from the Spanish rye ergot at present chiefly used. The sclerotia on oats are small and squat, but are sometimes in sufficient quantity to have caused accidents to horses. This appears to be rare, however, the amount being usually not more than 150 gm. per quintal [100 kg. or 220 lb.] which is not enough to be harmful.

Hence, though the ergot of diss grass is not likely to repay exploiting except in periods of great scarcity, that of oats is well worth consideration, and might replace the Spanish product with advantage.

STAKMAN (E. C.). **Diseases of cereal and forage crops in the United States in 1921.**—*Plant Disease Bull. Supplement* 21, pp. 139–254, 1922. [Mimeographed.]

It is impossible to exaggerate the value to the working plant pathologist of the annual summaries regarding the diseases of the chief crops of the United States issued by the Plant Disease Survey of the U.S. Department of Agriculture. They are compilations prepared chiefly from the reports of collaborators throughout the various states, and therefore cannot be readily abstracted. Not only is the occurrence, distribution, and intensity of the various diseases reported, but considerable information is accumulating on the epidemiology of many of them. The present report deals chiefly with cereal diseases; that on fruit diseases has been already noticed [see this *Review*, i. 11, p. 376].

Of particular interest is the discussion on the incidence of the various rusts of wheat in 1921. The areas affected by the three rusts do not coincide. Stem rust (*Puccinia graminis*) was most severe in Ohio, Michigan, Wisconsin, Minnesota, the Dakotas, Montana, and California, while leaf rust (*P. triticina*) did little damage in the north and west, but was severe in Oklahoma, Tennessee, North Carolina, and other eastern and central states. Stripe rust (*P. glumarum*) was confined to Montana, Idaho, Washington, Oregon, and California, and appears to be spreading east slowly. The underlying causes of this irregular distribution, the relation of climate and weather to the different rusts, the influence of barberry, the effect of varietal susceptibility, and other similar questions of general interest are discussed.

Two diseases of wheat have appeared in the United States recently, flag smut (*Urocystis tritici*) and take-all (*Ophiobolus cariceti*). Their distribution is fully described, and useful notes furnished regarding the losses caused, methods of dissemination, and treatment.

There is a full discussion of the various root rots and scabs of cereals, some of which are reported to be very widely distributed and to cause considerable losses. It is stated that one of the big problems confronting cereal pathologists is that of the foot and root rots, which are caused by species of *Fusarium*, *Helminthosporium*, and other imperfect fungi. Those on maize are regarded by Hoffer, in a note on pp. 226–229, as being for the most part secondary to the influence of unbalanced available nutrients in the

soil, the most important deleterious agents which become available in the soil solution being probably aluminium and ferrous-iron salts.

In the section on bunt of wheat the excellent results obtained from seed-treatment with chemical dusts are reported. The best appear to be copper carbonate dust and a dust consisting of equal parts of anhydrous copper sulphate and calcium carbonate, either of these dusts being mixed with the grain at the rate of 2 oz. per bushel. Bunt control is stated to be complete and injury to germination nil.

The greater part of the report is devoted to wheat, rye, barley, oats, and maize, the diseases of rice, sorghum, flax, and various forage crops being less fully dealt with. References are given to the chief publications dealing with particular diseases during the year.

SAWYER (A. M.). **Result of investigations made by the Department of Agriculture, Burma, into the extent of the damage caused by a parasitic plant known in Burmese as 'Pwinbyu' (Striga lutea).**—*Dept. of Agric. Burma, Bull.* 18, 7 pp., 5 pl., 1921 [1922].

Almost throughout the Burmese dry zone the sorghum crop, which covers about 350,000 acres, is liable to attack by *Striga lutea*, a full description of which is given in this bulletin. The pest is most severe on poor and light soils, such as those of the uplands, which have become exhausted from over-cultivation. On the heavier, deeper, and more fertile soils of low-lying districts the sorghum crop gets an early start and out-distances the parasite. Sorghum is sown from June to September, while *Striga* is most conspicuous from August to November, when its white flowers may be seen in dense groups among the light green stalks of the crop.

Striga is propagated exclusively from seed, immense quantities of which are produced from September to April. Germination can only occur when the seed is in contact with the roots of the host; otherwise the seed can remain dormant for several years (at least three) with no loss of vigour. Germination can take place readily at 1 ft. below the surface of the soil, and at any season of the year. Wind is by far the most important agent concerned in the dissemination of the seeds, which are extremely minute and light. Other common agents of dissemination are moving water, grazing cattle, the carting of infested crops, and the use of infected manure, implements, &c.

Amongst the plants on which *Striga* was found to be parasitic were maize, various millets, teosinte, Sudan grass, and thirteen species of wild grasses. Only five non-gramineous plants are listed as hosts, none of which are cultivated. Tests and observations indicate that it will not grow on beans and other pulses, cotton, sesamum, tomato, chilli, or coriander. Parasitism begins with the germination of the seed, and is absolute during the whole of the plant's underground existence, which lasts for about a month. The host is therefore most seriously affected during this stage, parasitism being only partial after the *Striga* has appeared above ground. The effect on the plant was indicated in pot cultures by a reduction

in transpiration, dry weight of plant, and dry weight produced per unit quantity of water transpired, the reduction in all cases being very considerable.

Owing to the variety of factors involved in the failure of sorghum crops in Burma it is impossible to estimate exactly the extent of the damage caused by this pest alone. The results of experiments conducted at Mandalay indicate the approximate loss as varying from 4 to 46 per cent. These figures represent the incidence on clay soil, and would probably be exceeded on the uplands.

Trials were made of common salt, saltpetre, nitrate of soda, nitrolime, superphosphate, copper sulphate, sulphate of ammonia, and potassium nitrate, applied to the soil in quantities varying from 50 to 200 lb. per acre with a view to killing the parasite, but all were unsuccessful, while the crop itself was injured in several cases. An attempt was also made to destroy the parasite by sowing a 'decoy' crop of sorghum, which, with the accompanying *Striga*, was ploughed under before the latter produced seed, and this was followed by another crop later in the season. The later crops, however, were as heavily infested as the 'decoys', the yield in all cases being less than that of the controls. On poor soil, besides, it is often difficult to establish even one crop, and a second opportunity seldom occurs.

The following practices are recommended with a view to lessening the damage:—The sowing of sorghum in rows 18 in. apart, followed by occasional intercultivation with a wheel-hoe. Thorough cultivation, drainage, manuring, and early sowing, with a view to establishing a strong stand early in the season. The burning of all stubble and rubbish on the field after the harvest. Rotation of crops.

CAMPANILE (G.). **Su di una malattia delle frutta di Mandarino (Cytosporina citriperda Camp.).** [On a disease of Mandarin Oranges (*Cytosporina citriperda* Camp.).]—*Le Staz. Sperim. Agrarie Ital.*, lv, 1–3, pp. 5–12, 4 figs., 1922.

The author describes a disease which this year destroyed large quantities of mandarins (*Citrus deliciosa*) in the markets at Rome, and which, so far as he is aware, has not previously been recorded. The cause is a fungus which is referred to *Cytosporina*, though differing from the typical forms of this genus (probably on account of its unusual habitat), and is named *C. citriperda* n. sp., a Latin diagnosis being given.

The first symptom is the appearance on the fruit of a rounded, generally slightly depressed, spot (rarely two or three), from 0·7 to 1·5 cm. in diameter, at first reddish-brown, and later black in colour. Under young spots the wall of the endocarp is strongly attached to the rind, and on the latter being removed, tears away with it, leaving the underlying pulp bare. Under older spots the rind with the attached endocarp wall is reduced to a black pulpy mass, 2 to 3 mm. thick, which extends into the flesh of the fruit: the latter shows a tendency to dry up. Eight or ten days later, secondary spots appear at different points of the epicarp, gradually assuming an appearance similar to that of the primary spot. The interior surface of the rind under these newly-formed secondary spots shows a light yellow discoloration, but is not attached to the

endocarp wall which remains intact; the underlying flesh is strongly blackened, granular in aspect, and thicker in consistence than the normal. At a more advanced stage the discoloration of the inner side of the rind is dark yellow; a black, gristly, irregular, lamelliform stroma, sometimes involving the endocarp between two contiguous segments of the fruit, and densely covered with pycnidia on both sides, is found immersed in the flesh. In some cases the infection reaches to the centre of the fruit and may even, though this occurs rarely, involve the seeds, the seed-coats becoming transformed into a black, granular, and extremely hard stroma. While pycnidia are constantly formed on the stroma in the endocarp, they occur very rarely on the exterior of the fruit. Among the very abundant material examined the author met with pycnidia on the surface of the fruit in two cases only. The essential difference between the primary and the secondary spots is that in the first the infection starts from the exterior and progresses inwards, while the secondary spots arise from an internal mycelium derived from the primary spot.

Artificial inoculations were successfully carried out by introducing a small piece of the stroma with pycnidia from diseased fruits, into small wounds in the rind of healthy ones. It still remains doubtful whether the fungus can penetrate in the absence of lesions in the rind; a careful examination of the diseased fruit failed to show any trace of insect or other external injury.

LEE (H.) & SHINO (A.). **Citrus canker control experiments in Japan.**—*Philipp. Journ. of Science*, xx, 2, pp. 121-150, 4 pl., 1922.

Experiments on the control of citrus canker (*Pseudomonas citri*) in the Philippines were described in a previous progress report by the senior author [see this *Review*, i, 7, pp. 213-215]. It was considered advisable to try further control measures in an orchard planted exclusively with the Washington navel orange (*Citrus sinensis*) in order to ascertain whether the methods already found to be effective were also commercially feasible. A series of experiments was therefore conducted at the Saigomura orchard in the Nagasaki Prefecture in Japan. The following is an outline of the seasonal conditions in the district, with their effects on the canker organism. November to May: temperatures usually below 20° C.; rainfall and canker dissemination very slight; no foliage or fruit development of the host plants from November to March. June and July: temperatures and rainfall increased and favourable to canker development; fruit and foliage of the host growing rapidly and liable to infection. Late July and early August: rainfall slight; not a period of serious canker development under ordinary conditions. August and September: possible typhoons with high wind velocities and heavy rainfall, favourable for the development and dissemination of canker; the fruit tissues are in a susceptible stage for infection. October and November: abrupt fall of temperature and decrease of rainfall: the fruit is nearly mature and no longer susceptible; canker activity may be disregarded.

The control campaign was organized with a view to applying protective spray coatings during the critical seasons of the heavy

rainfall in June and the probable typhoons in late August and September. The orchard was in good cultural condition but the owner had had serious trouble with citrus canker. A good windbreak on all sides was formed by a belt of coniferous trees. The tests were carried out in 1919 on eighteen-year old navel orange trees covering an area of about six hectares, and comprised applications of lime-sulphur (1 to 40, 32° Baumé concentration); Bordeaux mixture (4–4–50); neutral Bordeaux mixture; Burgundy mixture (3–3–50); and formalin (1 to 100). All the mixtures, except formalin, reduced the infection, especially both the Bordeaux mixtures. Lime-sulphur, though an excellent bactericide, was easily washed off by rain. Formalin was absolutely useless. Rough pruning slightly reduced the canker, while pruning and spraying combined resulted in a very fair measure of control.

The commercial aspect of the various treatments may be summarized as follows: copper sprays (without previous excision of cankers) cost 32·4 to 33·7 Japanese sen per tree, the number of affected fruits being reduced to 34·37, and 46 per cent. as compared with 80 to 96 per cent. on the untreated trees. Copper sprays accompanied by the removal of sources of infection before the period of canker activity cost 92 sen for Bordeaux 4–4–50, 90 sen for neutral Bordeaux, and 92 sen for Burgundy 3–3–50, while the canker was reduced to 9·25 per cent., 6·5 per cent., and 18·5 per cent. respectively. Excision of the sources of infection, without other treatment, cost 59·6 sen per tree, and reduced the cankered fruits to 45 per cent. Lime-sulphur by itself cost 31 sen and reduced canker, but not to such an extent as the copper sprays. Other observations showed that wind prevention alone may reduce the development of canker from 50 to 60 per cent. down to 6, 20, and 37 per cent. The cost of American and Japanese orchard labour is approximately equal, considering the greater efficiency of the former.

Considerable disadvantages accompanied the use of the copper sprays, the commercial value of the fruits being depreciated by the increased infestation of the red spider, sooty mould (*Meliola camelliae*), and a blemish identical in appearance with melanose (*Phomopsis citri*), to the extent of 100 per cent., 25 per cent., and 63 per cent. respectively. The two former may be avoided by the addition of oil emulsions to the copper precipitate sprays. The melanose injury was definitely correlated with the use of the neutral Bordeaux mixture. Lime-sulphur and formalin did not produce these effects. It is probable that the application of the copper sprays in June and July, and of lime-sulphur in August, would solve this difficulty. The luxuriant green of the foliage and the clear colour of the fruits in the lime-sulphur plots was particularly noticeable. The use of the sprays mentioned in these experiments caused no perceptible insipidity of the fruit such as is attributed to the action of lead arsenate (*Monthly Bull. Dept. Agric. California*, i, pp. 10–11, 1921).

The effects of citrus canker on Washington navels may be briefly summarized as follows:—(*a*) an indeterminable loss, due to a decrease in the functioning of infected leaves; (*b*) an insignificant loss due to the dropping of young fruits; (*c*) a commercial loss

owing to the blemish on affected fruits; (*d*) a slight reduction in weight of the cankered fruits; and (*e*) occasional secondary infection by fruit rots. The results of their experiments have convinced the writers that feasible control can be effected upon citrus fruits of the general susceptibility of the Washington navel, which is less susceptible than limes or grape-fruit but more so than the Mediterranean sweet orange, Satsuma, mandarin, lemon, citron, kumquat, and calamondin.

SAMUEL (G.). **Brown rot of Citrus fruit.**—*Journ. Dept. Agric. South Australia*, xxvi, 2, pp. 112–118, 5 figs., 1922.

Brown rot of citrus (*Pythiacystis citrophthora*) is reported in South Australia for the first time, oranges affected with the disease having been found in two localities in August 1922. In its early stages brown rot is difficult to distinguish from blue mould (*Penicillium* spp.), so that the disease may have been present for some years before being recognized.

Serious damage from brown rot is unlikely in South Australia, except possibly in the wetter districts. The spread of the fungus can probably be prevented by removing infected fruit from the ground.

An account is given of the methods adopted to combat the disease in California, and the life-history of the causal organism is described and figured [see this *Review*, i, 7, p. 211].

BARKER (B. T. P.), LEES (A. H.), WALLACE (T.), & WILTSHIRE (S. P.). **Leaf scorch on fruit trees.**—*Ann. Rep. Agric. & Hort. Res. Stat., Long Ashton, Bristol, for 1921*, pp. 77–121, 1922.

Since 1913 the causation of leaf scorch in apple and other trees has been under investigation at this Station. A type due to the action of wind, and another associated with certain soils ('scorching' soils) have been mentioned in previous reports. The scorches due to salt spray injury from sea winds and to the toxic action of spray fluids are not referred to in the present work.

In the type associated with 'scorching' soils the plantations affected can usually be picked out at some distance because of their brownish tinge instead of the normal green. The disease occurs in patches of various sizes which are not sharply defined from the surrounding healthy trees. The most obvious symptom of the trouble is the scorched appearance of the leaf-margins. Affected trees are also stunted in growth, this condition varying in accordance with the severity of the attack, but sometimes reducing the size so that trees fifteen years old are no larger than normal trees of five. The trouble usually coincides with the advent of dry summer weather, from the end of May to the end of June, though it is not necessarily confined to this period. The fresh growth which frequently follows rain, later on shows no sign of scorch. A moist season may either prevent the development of scorch on typical scorch plantations or considerably reduce its intensity. The roots are also affected in trees suffering from scorch, being insufficiently developed to give the tree a firm hold in the soil. The disease is most frequent on trees grown in arable soil, apples growing in grass being rarely affected. In the majority of cases 'scorching' soils

are of a light and sandy character and are often very stony, but a few, fairly light, loamy soils of less coarse texture, and even heavy loams of good depth which are decidedly 'sticky' in wet weather and difficult to work, may also bear scorched trees. Two non-typical forms of the disease, of which one occurs occasionally with comparative suddenness late in the summer, and the other in the autumn, just prior to leaf-fall, do not damage the trees seriously.

Another type of scorching associated with soil conditions has been under close observation and treatment at Long Ashton, and differs from the above in that the scorch, instead of affecting only the margin and tip of the leaf is irregularly distributed over the surface. Affected leaves are, as a rule, much undersized. The discoloration begins soon after the unfolding of the new foliage and growth almost ceases by midsummer. The appearance of the plants was strongly suggestive of defective nutrition, and the response to artificial fertilizers was rapid and most striking.

A further type of scorch, reproducing the typical marginal and tip discoloration of the leaves, occurs in gooseberry bushes, in association with the die-back disease of those plants caused by *Botrytis cinerea*. A well-defined marginal scorch has also been produced experimentally on peach trees by applying lithium carbonate to the soil. A chance observation of leaf scorch produced by fire makes it clear that when the foliage of a tree is exposed to temperatures just sufficiently high to cause some injury to it, the marginal areas of the leaves are the first parts to suffer.

Experiments are described in which the object was to reproduce leaf scorch artificially under controlled conditions. From these trials and observations it appears that the cases of leaf scorch recorded fall into a number of more or less distinct categories, according to whether the disease is due to soil conditions, wind, heat, or injury to the vascular system of the tree. In no case, except in a few belonging to the last of these groups, could parasitic action, even at a distance, be held responsible for the trouble. To arrive at conclusions regarding the manner in which these unhealthy conditions arise within the cells the evidence available for each of these four groups of cases is discussed separately.

In the first group, soil influence is of a varied character, but the main feature which the cases under test had in common was a relatively poorly developed or defective root system to which the symptoms of scorching could be directly traced. Fertilizer experiments and analyses of scorching soils indicate that these cases of scorch may possibly be referred exclusively to a lack of potash salts, though a lack of nitrogen may sometimes co-exist. The mechanical character of the soil also seems in some cases to be concerned in the production of scorch, lack of adequate aeration resulting in a poor development of the roots; the same effect may be caused by poor water-lifting or water-holding soils. The authors think that damage to the root system by insects or fungi during the early part of the growing season might produce scorching, provided it was extensive enough, but no such case was seen.

In the second group, drying winds may cause excessive transpiration, or the leaf tissues may be affected locally by the chafing of one leaf upon another when stirred by breezes, but it is not clear

whether, in the latter case, unhealthy cell conditions are set up through mechanical irritation, or whether the cuticular surface is weakened and excessive transpiration follows.

In the third group must be included cases of scorching of foliage under glass and of spot scorching after watering in hot sun, but these are probably rightly regarded as burns pure and simple.

The fourth group includes an example of scorching preceded by bark-ringing in the case of a plum tree, and also the marginal scorch frequently seen on the foliage of trees attacked by a vascular parasite, such as *Botrytis cinerea*.

The general conclusion is reached that excessive transpiration, or more accurately, unbalanced water relations of the leaf tissues, are apparently involved in all the cases of scorch referred to, this resulting sometimes from direct action on the leaf and sometimes indirectly through the roots.

Whilst there are factors connected with leaf scorch which still await elucidation, the practical side of the present investigation gives hope of a considerable degree of control in many instances. The three outstanding factors in this connexion are potash effect, influence of grass, and root-stock action. The experiments have shown that a liberal application of potash manures constitutes one of the most certain remedial measures in many cases. The fact that trees growing in grass rarely suffer from scorch is still unexplained, but the evidence suggests that the trouble may be reduced or even eliminated by growing a cover-crop of grass. The importance of active root growth indicates that only trees worked on free growing types of root-stock should be planted on 'scorching' soils, and that cultural operations tending to encourage active root growth, and manurial treatment with the same object, must necessarily lead to greater resistance to the disease. Nitrogenous fertilizers should be used sparingly, as these encourage the production of a dangerously large leaf surface. In the treatment of scorch it will be found of advantage to withhold all nitrogenous dressings until an improvement by means of potash alone has been secured. In the case of wind scorch, where plantations are unavoidably situated in wind-swept localities, the establishment of wind-breaks should lessen the trouble.

BARNUM (C. C.). **Stem end rot of Apples.**—*Science*, N.S. lv, pp. 707–708, 1922.

Apples removed from cold storage in California were found in some cases to show rot at the stem end caused by *Penicillium expansum*. It appeared that the fungus had entered the fruit through the attached stem. Since this method of infection appeared not to have been noted previously, the author tested it experimentally by inoculations and found that *P. expansum* can readily enter the apple after it has been removed from the tree by growing down the stem into the fruit.

WORMALD (H.). **Observations on a Discomycete found on Medlar fruits.**—*Trans. Brit. Mycol. Soc.*, vii, 4 pp. 287–293, 2 figs. 1922.

The author describes the fructifications of a fungus which

developed in the spring of 1921 on mummified medlar fruits collected a year earlier under trees affected with leaf blotch. The fungus, which is believed to be the cause of the leaf blotch disease, differed but slightly from *Sclerotinia mespili* as described by Schellenberg. The differences noticed consisted in the narrower ascospores and in the stalk of the apothecium developing from the apex of the primary protuberance, not from the base as stated by Schellenberg. The direct connexion between this Discomycete and a *Monilia* with disjunctors found on the diseased leaves was not traced, but the fact that the fungus isolated from the mummies showed the same habit when grown in plate cultures as that isolated from the leaves, is suggestive that the two forms are stages in the life cycle of the same fungus.

STEVENS (H. E.). **Avocado diseases.**—*Florida Agric. Exper. Stat. Bull.* 161, 23 pp., 6 figs., 1922.

Avocado scab (*Cladosporium citri* Massee) has developed to a considerable extent in Florida during the past few years. It is common on the foliage of seedlings of West Indian avocadoes, and is difficult to control on young plants in the nursery. Fruits of the Trapp, Taylor and Fuerta varieties seem to be especially susceptible to scab. The injury is usually superficial on the fruits, but their appearance is marred, and the disease probably results in the shedding of many young fruits. Cool, wet weather favours the development of scab, and only young and tender growth is attacked; the fruit may become infected from the time the bloom drops until six or eight weeks later, but the principal injury occurs during the week or two after the bloom drops.

The disease occurs on young leaves and shoots as definite spots or patches, and in severe infections the leaves may be curled or distorted. The small, purplish-brown or dark spots are usually more prominent on the upper surface of the leaf. Sometimes a shot-hole appearance is caused. The spots on the young shoots, twigs, and leaf petioles are oval, and darker and more elevated than on the leaves. The spots on the fruits resemble those on the twigs, and in severe infections they may be so numerous as to give a roughened, russet, or scabby appearance.

C. citri from avocado will cause typical infections on either avocado or citrus, but a few trials with the fungus from citrus failed to cause infection on avocado, indicating that certain strains of *C. citri* have adapted themselves to avocado.

Tests showed that scab on the fruits can be largely prevented by appplying 3-3-50 [3-3-40, Imperial gallon] Bordeaux when the trees are in bloom, then two later applications at three-weekly intervals. For nursery stock a 4-4-50 Bordeaux before the growth starts, followed by ammoniacal copper carbonate every seven to ten days until the new growth becomes hardened, is recommended.

Black spot occurs as round, brown to black spots, from one-eighth to one-half inch in diameter, which are composed of hard, dry, corky tissues extending through the skin of the fruit. The bark of young shoots and fruit stems may also show the spots. The disease is caused by a *Colletotrichum* which appears identical with *C. gloeosporioides* Penz. The fungus gains entrance to the

living avocado tissues apparently only through injuries. Tests indicated that the disease can be controlled by two or three applications of Bordeaux (3-3-50 or 4-4-50) beginning three or four weeks after the bloom has disappeared and renewed at three-weekly intervals.

Avocado blotch occurs on the fruit, and is likely to be confused with black spot. The blotch spots appear first as pale green areas on the fruit, showing one or more minute brown or black dots. The spots darken and finally become irregular and sunken. A few cases of blotch were found on fruit stems. The disease is caused by an undetermined *Cercospora*. It usually occurs in association with black spot, and the same control methods are effective.

Rusty blight, caused by *Gloeosporium* sp., occurs chiefly on the foliage and young branches. The infected leaves turn rusty brown, and affected parts are often concentrically marked. The tree may be largely defoliated by the attack. The twigs may die back, and the blooms are often damaged. Bordeaux mixture (4-4-50) is recommended for control, together with removal of infected branches.

Powdery mildew (*Oidium* sp.) was found, but is probably not serious.

Russeting of the fruits is not uncommon, and may be caused by insects, by mechanical injuries, or by certain fungi. One type resembles melanose of citrus fruits in outward appearance, and is thought to be the effect of fungous injury.

HARTER (L. L.) & WEIMER (J. L.). **Decay of various vegetables and fruits by different species of Rhizopus.**—*Phytopath.*, xii, 5, pp. 205–212, 1922.

Decay of vegetables and fruit from the action of fungi of the genus *Rhizopus* is usually attributed to *R. nigricans*. The present study was undertaken to test the ability of other species of the genus to cause decay similar to *R. nigricans*. Eleven species of *Rhizopus* were tested on twenty-seven different hosts, all of which were susceptible to decay by some of the species. From the results of the inoculations, full details of which are given, the different species were arranged in three groups, according to the optimum temperature for infection; *R. chinensis* represents the high temperature group (35° C), *R. oryzae*, *maydis*, *tritici*, *delemar*, *nodosus*, and *arrhizus* the intermediate group (30° C), and *R. artocarpi*, *reflexus*, *microsporus*, and *nigricans* the low temperature group (20–22° C). *R. microsporus* and *R. chinensis* proved more or less non-parasitic, infecting only a few of the hosts and those comparatively slightly. On the whole, the species of the intermediate group, which are seldom found causing decay, exhibited a more vigorous parasitism under artificial conditions than those of the low temperature group. *R. nigricans*, however, produced less percentage infection than *R. artocarpi* or *reflexus*, although it seems to be responsible for most of the decay of fruits and vegetables in storage and on the markets.

The ease with which infection took place varied with the host, the method of inoculation required apparently depending on whether or not the host was juicy or relatively dry. None of the hosts

could be infected without wounding, except ripe peaches, which became infected on being dipped into a spore suspension, sporangiophores finally growing outward through the skin and fruiting abundantly. It was found that a considerable percentage of the decay attributed to brown rot (*Sclerotinia cinerea*) of peaches and plums was apparently in reality due to *Rhizopus nigricans*.

ALLEN (W. J.). **Orchard experiments. Spraying trials at Glen Innes Experiment Farm.**—*Agric. Gaz. of New South Wales*, xxxiii, 2, pp. 113–119, 1922.

Trials of various fungicides were carried out at Glen Innes Experiment Farm during the season 1920–21 for the control of powdery mildew and of black spot [*Venturia inaequalis*] of the apple.

For powdery mildew 10 lb. 'atomic sulphur' to 83 galls. water gave the best control. The first spraying should be done at the spur-bursting stage and this should be followed by three sprayings with atomic sulphur combined with lead arsenate at the regular periods prescribed for the control of codlin moth.

Sulphuric acid at a strength of 1 part to 1,500 parts by volume of water controlled powdery mildew fairly well. As injury results when it comes in contact with lead arsenate this treatment is unsuitable where the latter has to be used.

Colloidal sulphur and colloidal sulphur paste, prepared by precipitating the sulphur in lime-sulphur solution, have given equal results to atomic sulphur in controlling powdery mildew during the two seasons. The paste was successfully used in combination with lead arsenate.

The present treatment recommended by the Department is to cut out and burn all mildewed twigs during winter pruning, and to remove as far as possible all mildewed terminal buds. Spray with atomic sulphur (10 lb. to 80 galls. water) from spur-bursting to pinking stage. Spray with atomic sulphur combined with lead arsenate at the periods prescribed for the application of the latter for the control of codlin moth.

No outbreak of black spot has occurred at the farm, and the effect of fungicides in its control could not be determined. Bordeaux mixture causes severe russeting of the fruit in the Glen Innes district. Lime-sulphur caused no damage and gave a slight control of powdery mildew.

Search for a combined spray to control both diseases was also ineffective on account of the absence of black spot. It was found however, that atomic sulphur combined with lime-sulphur, first at spur-bursting strength (10 lb. sulphur to 83 galls. total combined spray) and later with lime-sulphur at summer strength for apples and pears, these later sprayings being made in conjunction with applications of lead arsenate, caused no injury and controlled powdery mildew.

The russet injury from Bordeaux mixture does not occur if the spray is applied at early spur-bursting, when only the tips of the enclosed blossom buds are exposed. Bordeaux mixture gave slight control of mildew this season but has ordinarily failed to control this disease. Both it and lime-sulphur retard the growth of the

apple and pear trees and fruit, when the full four applications are made. The same strengths of lime-sulphur as are recommended in departmental publications for apple spraying can be used on the varieties of cherries tested without causing injury. They cannot safely be used on peach, nectarine, apricot, and Japanese plum trees later than the pinking stage.

Full details of the experiments are given.

BRERETON (W. LE GAY), HAMBLIN (C. O.), & STOKES (W. B.). **Black spot of Pear and Apple. Some orchard experiments.**—*Agric. Gaz. of New South Wales*, xxxii, 2, pp. 123–130, 3 figs., 1922.

This is an account of experiments on the control of black spot or scab of pear and apple (*Venturia pirina* and *inaequalis*), in orchards at Turramurra and Towrang between 1917 and 1921, the apple trials taking place in 1920–1921. The perithecial stages of these fungi were found for the first time in New South Wales in 1920.

Lime-sulphur was tested on Williams pears but was found to cause burning of the leaves and was therefore discontinued. Of various strengths of Bordeaux mixture tried, the formula 6–4–80 gave the best results; the slight amount of russeting produced in no way depreciated the fruit value, while the treatment was successful in controlling scab. 'Pickering' Bordeaux also gave efficient control, though it marked the fruit rather more severely. The 1921–1922 season was very favourable to the disease and the control trees bore about 90 per cent. of badly spotted fruit, while the treated plots had less than 5 per cent.

Apple scab trials took place at Towrang in 1920–1921. Atomic sulphur, lime-sulphur, and Bordeaux mixture were used and 100 trees in all of several different varieties received treatment, but as the amount of black spot was very limited, no conclusions could be drawn as to the effectiveness of the sprays. Bordeaux mixture 6–4–50 resulted in serious russeting of the fruit, especially where two applications were made. This experience seems to have been general on the tablelands. Lime-sulphur solutions have not caused russeting, but cannot be said to have been proved as yet to be effective in the control of the disease.

The Department's recommendations for controlling black spot include the ploughing in of all fallen leaves in the autumn and the cutting out and burning of all dead wood. Working the ground in the spring at flowering time helps to spread the spores and is not advised. The following spraying programme is recommended as the most likely to give complete control:—Bordeaux (6-4-50) or lime-sulphur (spur-bursting strength) at from spur-bursting to pinking stage. Lime-sulphur or Bordeaux (summer strength) when the petals are falling; this second application to be combined with the first lead arsenate spray for codlin moth. If weather conditions favour the disease, the same spray should be used with the second and third applications of lead arsenate. Finally, an autumn spraying with winter strength Bordeaux (6–4–22), before the leaves have fallen, but after the picking of the fruit, is required when the disease has been severe during the season, and is valuable as an insurance for next season.

It is stated that Bordeaux mixture applied five weeks after the falling of the petals causes very little russeting. The spraying of Trevitt apples or Williams pears grown in the coast districts with lime-sulphur solutions after the spur-bursting stage is not recommended.

LINDFORS (T.). **Ett besprutnings försök mot äppleskorv sommaren 1921.** [A spraying experiment against Apple-scab in the summer of 1921.]—*Medd. från Centralanst. för försöksväsendet på jordbruksområdet* 227, 10 pp., 3 diags., 1922.

Experiments were carried out at the Swedish Central Agricultural Research Station to test the action of 'solbar' (Bayer & Co., Leverkusen, Germany) and 'frisco' (Phylatterion Ltd., Trelleborg, Sweden) on apple scab [*Venturia inaequalis*]. Both preparations were made up according to the prescribed formulas (1:100 and 1:22 respectively). The trees were sprayed twice, at the beginning of June and early in July. Better results were obtained with frisco than with solbar, the concentration of which was presumably too low. An analysis of the preparations showed that frisco contained about three times as much polysulphide sulphur as solbar, when diluted according to the instructions for spraying. Varietal susceptibility was very marked, a considerable degree of resistance being exhibited by Keswick Codlin, Codlin's Spring Grove, Ribston, and Golden Noble, while Säfstaholms-äpple, Alexander, and Signe Tillisch had a high proportion of scab in all cases.

HOWITT (J. E.). **Results of four years' co-operative experiments with (dry) formaldehyde for the prevention of Oat smut.**—*Ann. Rept. for 1921 Agric. and Exper. Union, Ontario Dept. of Agric.*, pp. 27–30, 1922.

The average annual loss from oat smut [*Ustilago avenae*] in Ontario is stated to amount, at a conservative estimate, to $3,000,000. The so-called dry formaldehyde treatment of the seed is extremely effective in the prevention of the disease, and co-operative experiments under ordinary farm conditions have been carried on for the last four years to convince farmers of the advantage of the method. Thirty-five trials were made altogether and 2,122 bushels of oats treated. The varieties of oats included O.A.C. No. 72, Alaska, Banner, White Cluster, Mammoth Cluster, and Siberian. The average of the results for the four years showed no smut in the crop from treated seed and 4·23 per cent. of infection in the crop from untreated seed. The average germination of treated and untreated seed was found to be identical, viz. 97·5 per cent.

The results of the treatment were therefore uniformly satisfactory throughout, the vitality of the seed being unimpaired and the control of the smut complete. In no case was there more than a trace of infection present in any of the fields sown with treated seed, while in some of the checks there was over 15 per cent. of smut. This method of treatment combines simplicity with rapidity and ease of application. It was found that one hundred bushels of oats could be treated in fifty minutes, and there was no necessity to wait

for the seed to dry afterwards. The grain did not sprout, get mouldy, or swell.

The oats to be treated should be placed in a pile and shovelled over into another heap, the spraying being done during this process. The solution should consist of one part of formalin (40 per cent. formaldehyde) and one part of water, to be used at the rate of one pint to twenty-five bushels of oats. The irritation to the eyes, nose, and throat caused by the formalin fumes can be prevented by holding the sprayer close to the grain and allowing the air to circulate freely through the granary. After the oats are all sprayed they should be piled in a heap and covered with sacks or blankets, which should be sprayed with the same solution inside and out before use. After five hours the seed should be uncovered and sown as soon as possible afterwards. A slight reduction in germination may result from any delay in sowing. There is no need to wait for the seed to dry as the moisture is so slight that it is imperceptible and will not affect drilling.

BARKER (E. T. P.) & WALLACE (T.). **A new method of sulphur fumigation.**—*Ann. Rept. Agric. and Hort. Res. Stat., Long Ashton, Bristol, for 1921*, pp. 122–124, 1922.

Investigations on the fungicidal action of sulphur have been in progress for some years at the Station. The present note is concerned with methods of vaporizing sulphur in a fungicidally active form.

The toxicity of a treated atmosphere depends upon the presence in it of sulphur particles of varying size, some so small as to be barely visible under the highest magnification, and even these may be aggregates of still smaller particles. The toxicity to fungi of such an atmosphere may be removed from it by filtration, thereby demonstrating that the effective sulphur is not in the form of vapour but of definite particles. When air containing particulate sulphur is passed into water, a suspension of colloidal sulphur is obtained. Sulphur distributed on growing plants through the atmosphere in this particulate form furnishes a much more complete superficial covering than can be secured by dusting or dry-spraying with flowers of sulphur, and also adheres so firmly as to withstand heavy rain or jets of water of considerable force. The usual method of applying it in this form is by coating the hot-water pipes of the greenhouse with a paste of sulphur or by placing shallow pans of flowers of sulphur in the houses.

An improvement in respect of control is offered by the so-called 'vaporization' method, utilized in fumigators such as 'Campbell's Vaporizer'. It consists in boiling sulphur under such conditions that the vapour evolved condenses to a cloud of very finely divided particles of sulphur. The temperature of the sulphur is, however, raised above its ignition point in this method, and there is a danger of its burning which would result in the production of sulphur dioxide and injury to the growing plants.

These drawbacks have been avoided in a new method worked out at Long Ashton. It consists in passing a current of air over or through molten sulphur. The melting point of sulphur is about 115° C., its ignition point in air about 260° C., and its boiling point

about 440° C. The most satisfactory temperatures of molten sulphur for the air-blast treatment appear to lie between 170° and 230° C., so that there is no risk of ignition in this treatment. The best yield of particulate sulphur is got by passing air from a perforated nozzle in a series of fine streams through the molten sulphur. So far only forms of apparatus suitable for laboratory and small greenhouse work have been tested, but the method is believed to have considerable prospects of being adopted for field use.

The method recommended by Vogt [see this *Review*, i, 1, p. 29] appears to produce a cloud of particulate sulphur of substantially the same character as that described above, but the objections to it are that the temperature is raised above the ignition point of the sulphur and that appreciable quantities of sulphuretted hydrogen are likely to be formed.

BRAUN (H.). **Effect of delayed planting on germination of seed Wheat treated with formalin.**—*Phytopath.*, xii, 4, pp. 173–179, 3 figs., 1 pl., 1922.

Experiments carried out in December 1921, and repeated in January 1922, on five varieties of wheat, viz. Marquis, Fultz, Turkey, Purple Straw, and Fulcaster, showed that the ordinary formalin treatment of wheat reduced germination considerably, especially if the seeds were kept a week before planting. Seeds subjected to the pre-soak formalin treatment, however, were not appreciably injured, even if kept a week before planting, whilst those planted a day after treatment were somewhat stimulated.

The full discussion of the causes involved is reserved for a later paper. Attention is drawn, however, to the hardening effect of formalin on the pericarp, which may prevent or delay the primary root from pushing through it. The absorption of water vapour by seeds previous to treatment tends to counterbalance this hardening effect. Another possible cause of the injury is the persistence of paraformaldehyde on the surface, or a concentrated solution of formaldehyde within the pericarp, of treated seeds, pre-soaked seeds, however, retaining much less formaldehyde or paraformaldehyde in or on their coats than seeds treated by the usual formalin process.

KOMURO (H.). **Preliminary note on the cells of Vicia faba modified by Roentgen rays and their resemblance to tumour cells.**—*Botan. Mag., Tokyo*, xxxvi, 424, pp. 41–45, 1922.

In a new series of experiments on the effect of X-rays upon the mitoses in the cells of *Vicia faba*, the author found that on account of the abnormal development of mechanical tissues, the tips of the rootlets of seedlings grown from irradiated seeds were harder than those of the controls. The cells of the former showed very few mitoses; almost all the cases observed were anomalous, the chromosomes having become fragmented and scattered in the cytoplasm. Both nuclei and nucleoli were increased in size, but no definite transitional stages were seen. In every case vacuolization of the nucleoli was observed. In some cells the nucleolus had escaped from the nucleus, and in many others the protoplast was separated from the cell wall. In the periblem tissue many cells showed

karyolysis, while some were in a coudition of pycnosis; the writer does not believe this pycnosis to be an artifact, since the epidermis and the neighbouring tissues, both in longitudinal and transverse sections, were disturbed in comparison to those of the controls. Even in the tissue adjacent to the growing point pycnotic cells were found. A decrease of chromatic substance was noticed in the nuclei, more usually in those with more than two nucleoli (this agrees with Kimura's observations on tumour cells), a reticular chromatic structure being found in young cells only. Giant cells were very often met with; the nucleus was enlarged so as almost to fill an entire cell, and in such cases many nucleoli were found scattered in the cytoplasm.

The author is inclined to think that changes such as described above mean senescence of the cytoplasm and that the karyolytic and pycnotic conditions may, with a high degree of probability, be taken as outward expressions of the approaching end of cell life. Referring to his examination of Kimura's preparations of tumours (carcinoma of horse testis and polymorphic sarcoma of man), while the author is not prepared to compare the changes of cell elements in his case with the degenerative changes of tumour cells, he thinks that it may be safely said that a heavy irradiation of the seeds of *Vicia faba* with X-rays induces in the cells of the radicles a diseased or senescent condition resembling that of tumour cells.

RAND (F. V.), BALL (E. D.), CAESAR (L.), & GARDNER (M. W.). **Insects as disseminators of plant diseases.**—*Phytopath.*, xii, 5, pp. 225–228, 1922.

Under this heading are included four papers read at the joint session of the Phytopathological Society and the American Association of Economic Biologists on 31st December, 1921. The authors, in the order given above, spoke on the following aspects of the subject:—1. Results of past investigations; 2. Systematic relations of carriers; 3. Control problems; 4. Urgent problems of the future. A bibliography containing thirty-four entries is appended.

VALLEAU (W. D.). **Some seed-borne diseases of agricultural crops.** Abs. in *Science*, N. S. lvi, p. 16, 1922.

Fusarium moniliforme was found to be 'practically universal' in maize seeds. The fungus is carried between the seed-coat layers, and may extend to the aleurone layer. In very flinty corn the organism remains dormant for a longer period after the seed is planted than in the case of poorly filled, starchy kernels.

A preliminary study of wheat, oats, and barley seed-grain indicates that they are commonly infected with pathogenic organisms. Lettuce seed was often found to carry an organism believed to be the cause of lettuce root rot. The organism of root rot of clovers seems also to be transmitted by the seed.

TWORT (F. W.). **A theoretical study of the nature of ultramicroscopic viruses.**—*Veterinary Journ.*, lxxviii, 8, pp. 283–291, and 9, pp. 324–330, 1922.

Throughout this paper the view is taken that there is no proof that any true ultramicroscopic virus has been seen or grown. The turbidity obtained by many workers with certain of these viruses

in Noguchi's medium is not accepted as definite proof that cultures have been obtained, as similar phenomena can be observed in sterile organic media and soil filtrates.

The author has cultivated a spirochaete from a mouse and certain delicate vibrio-spirilla from soil, which in fluid cultures passed through a Berkefeld filter but not a Doulton white porcelain filter. In yellow fever the causal agent, which is believed to be the leptospirillum described by Noguchi, will pass even a fine porcelain filter, though it is an organism of not inconsiderable size. The composition of the medium, temperature, pressure, the structure of the organism, and other factors are all capable of influencing filtration through porous porcelain. Filter passage is, therefore, not by itself evidence that the causal agent of a disease is ultramicroscopic.

The author's repeated attempts to establish cultures of saprophytic ultramicroscopic organisms (which one would expect to occur, and to be more readily cultivated than the pathogenic forms) were failures. He considers it unlikely that ultramicroscopic viruses are merely very small bacteria. He supposes that more primitive forms of life than the bacteria and protozoa must exist, and that among them may be included pathogenic forms. The filter-passing lysins associated with many bacteria have been regarded by some as ultramicroscopic viruses, and have been shown to be capable of transmission from culture to culture and to increase. Even the lysozyme obtained recently by Fleming from normal body fluids, &c., is stated to be capable of increase under certain conditions when isolated. It is regarded as improbable that the ultramicroscopic viruses can be simple chemical substances or simple enzymes, and though they may be more complex enzymes, they are probably still more highly organized bodies. Such bodies may be represented by the suggested pre-cellular forms of life and be situated, in a sense, between the simple enzymes and the bacteria.

Poole (R. F.). **Celery mosaic.**—*Phytopath.*, xii, 3, pp. 151–154, 1 pl., 1922.

The symptoms of this disease, as found in New Jersey, are conspicuous. The foliage is sometimes drooping, wilting, or spreading, but more usually is erect. The leaves often become filiform and produce a bushy top, while blister-like spots may appear on them. The affected parts are very brittle but show no alteration in colour. Aphids from diseased plants were transferred to healthy plants of the Golden Self Blanching variety, and in two weeks the latter showed symptoms of mosaic. New leaves developing after the older leaves were affected also showed the disease, even when aphids were absent. Several varieties of celery were found to be susceptible.

The author can account for the appearance of the disease only on the assumption that it may have been transmitted to the celery from adjacent tomato plants which showed mosaic.

Rand (F. V.). **Pecan rosette: its histology, cytology and relation to other chlorotic diseases.**—*U. S. Dept. of Agric. Bull.* 1038, 42 pp., 12 pl. (1 col.), 1922.

After a brief introductory survey of the nature of chloroses,

general and infectious, the previous work on pecan rosette is summarized. The disease was first recognized by fruit growers in 1900, but the earliest published full account appeared in 1914, when the independent investigations of Orton and Rand were collected in the form of a joint paper (*Journ. Agric. Res.*, iii, pp. 149–174).

Trees of all ages are affected by rosette, the most constant sign of which is the development of undersized, crinkled, and yellow-mottled leaves, especially at the ends of the branches. The chlorotic areas are situated between the principal veins, and in severe cases may be thinner than the normal. Along the midrib and principal veins the blade is often rather thicker than in healthy leaves. Affected leaves have an undulated appearance of the laminae, parts of which are often absent. In slight cases, or at an early stage, yellow mottling may be the only external sign of the disease. Later, when the branches also become affected, there is considerable reduction in growth, and the leaves are compressed into clusters, giving the typical bunched appearance. The nuts borne on such branches are usually small and misshapen. The symptoms may appear over the whole tree at once or be confined at first to one or a few branches. In severe cases the affected branches begin to die back from the tip during the latter half of the growing season. Brownish spots and streaks develop in the chlorophyllous inner bark, and increase in size until the bark and cambium are disorganized. This 'staghorn' phase is followed in the same and subsequent seasons by the development of abnormal numbers of shoots from dormant and adventitious buds. With each repeated sequence of premature abnormal growth and dying back, the new twigs and leaves tend to become more and more depauperate.

The disease is fairly well distributed over the pecan-growing districts in the south, but has not been reported from the northern limits of pecan culture. Previous investigations have shown that rosette is not restricted to any soil type, season, or topography. In the alluvial river bottoms of Texas, Louisiana, and Mississippi, however, it is comparatively rare, these environmental conditions being natural to the tree. In dry, sandy, upland soil the disease is much more prevalent. According to McMurran, 90 per cent. of the cases which he observed were found under conditions denoting lack of humus, plant food, and moisture. The transplantation of rosetted trees to better conditions almost always effects their recovery; on the other hand, healthy trees used to replace diseased ones generally contract rosette.

Tests with fertilizers showed that most plots to which lime was applied, especially those receiving lime and acid phosphate, combined either with muriate of potash or nitrate of soda, developed cases of rosette, while none appeared in the untreated control plot or in plots receiving muriate of potash with acid phosphate or stable manure with and without ground bone. Chemical analysis of the soil indicated that the presence of lime alone was not sufficient to account for the disease, since the percentage of calcium was higher in parts of the orchard which were free from rosette. In ash analyses of normal and diseased leaves and twigs the

percentage of potassium appeared to be greater in the latter, but no other clear differences could be distinguished.

The fluctuation in the disease from year to year and its appearance in patches suggest that climatic and soil conditions are in some degree responsible. The negative results of attempts to isolate a causal organism or to transmit the disease by inoculation or grafting, and also the success of transplantation in effecting a cure in many cases, indicate that the cause is not a parasite, though the evidence is not conclusive and, in particular, the possibility of insect transmission has not been examined. There is no evidence of varietal differences in resistance to the disease.

Internal abnormalities of structure and metabolism in the leaf correspond in degree with the external manifestations. They are, in general, similar to those that have been described in the infectious chlorosis group of diseases, including mosaic and yellows. The histological changes may differ greatly in a comparatively small area of the leaf, and the most varied types of tissue derangement are found in the same leaf. The number and size of the cells, the differentiation of the tissues, the amount of intercellular space, and the variations in leaf thickness are all liable to great modification. The assimilation and translocation of starch are also profoundly affected. In the centre of the yellow spots the plastids are almost wanting, while there appears to be practically complete inhibition of translocation of starch from mottled leaves.

All the histological and cytological data hitherto ascertained in regard to this disease point to a much greater similarity to the known infectious chloroses than to the types of chlorosis due to soil or other environmental influences. Whether the factors responsible for causing pecan rosette must be introduced into the plant from without or may originate within the plant itself is a question that cannot yet be answered.

MELIN (E.). **Boletus-Arten als Mykorrhizenpilze der Waldbäume.** [Species of *Boletus* as mycorrhizal fungi of forest trees.]—*Ber. deutsch. bot. Gesellsch.*, xi, 3, pp. 94-97, 1922.

In 1921 the author isolated three genuine mycorrhizal fungi from *Pinus sylvestris* and one from *Picea abies* [see this *Review*, i, 4, p. 122]. They failed to form fruit bodies in pure culture, but the presence of clamp-connexions suggested that they were Hymenomycetes or Gasteromycetes. The synthesis of a mycorrhiza by the inoculation of sterile plants with the mycelium of a known forest fungus is necessary to establish the identity of the fungus symbiont, and this has now been accomplished by the writer with species of *Boletus*.

It has recently been pointed out by Romell [see this *Review*, i, 7, p. 233] that symbiosis frequently occurs between *B. elegans* Schum. and different species of larch, and between *B. luteus* and the pine. In July, 1921, cultures were obtained of the following:—*B. edulis*, *B. luteus*, *B. variegatus*, *B. subtomentosus*, *B. piperatus*, and *B. scaber*. The colonies of *B. luteus* greatly resembled the fungus previously isolated from the pine mycorrhiza. Inoculations were made as noted below.

Three months old seedlings of *Pinus sylvestris* were inoculated

on 25th August with the mycelium of *B. luteus*. By 2nd November the upper lateral roots had developed into typical mycorrhiza, hyphal strands 50 μ in thickness running into the substratum. The lower lateral roots were not infected at this date, and the root hairs were well developed. This synthetic pine mycorrhiza closely resembles that of *Mycelium radicis sylvestris a* as previously described by the author, but it is impossible to decide whether they are identical since other species of *Boletus* might present a similar appearance.

Experiments with *Boletus luteus* and *Picea abies* were similarly conducted. There were no typical mycorrhiza by 9th November, but the fungus had formed thick hyphal strands round the upper lateral roots. The formation of mycorrhiza can probably be induced with greater facility in the pine than in the fir.

Seedlings of *Larix europaea* were inoculated in the summer with mycelium of *B. elegans*. By November the upper lateral roots had all developed mycorrhiza. Hyphal strands about 50 μ in thickness extended some distance into the surrounding sand. The fungus had not penetrated the lower lateral roots. Root hairs were entirely absent, and the partially-divided epidermal cells had curved out from the root in the shape of a crescent. These cells can probably act as root hairs. *Boletus elegans* may form mycorrhiza in other species of larch, but apparently not in *Pinus sylvestris* or *Picea abies*. It occurs only in the immediate vicinity of larches, of which it is probably an obligate parasite.

These experiments conclusively prove that the so-called humus fungi of the forests take part in the formation of ectotrophic mycorrhiza. *Boletus* is not the only genus involved, at any rate in the case of *Pinus* and *Picea*, for it very seldom forms clamp-connexions, and these structures were found in certain of the fungi isolated from roots.

GARD (M.). **L'Hydnum erinaceus Bull. sur Noyers.** [*Hydnum erinaceus* Bull. on Walnut trees.]—*Bull. Soc. Path. Vég. de France*, ix, 1, p. 21, 1922.

The author found sporophores of *Hydnum erinaceus* growing on mechanical or frost wounds of walnut trees in two different localities in France. As far as he is aware, this is the first time that the fungus has been recorded on this host. It does not appear to be a dangerous parasite, but its action on the wood of the host has still to be investigated.

KAR (P. C.). **'Bud-rot' of Palmyra Palm.**—*Bengal Agric. Journ.*, i, 4, pp. 110-111, 1921 [1922].

Bud rot of Palmyra palm, due to *Phytophthora palmivora* Butl. (*Pythium palmivorum*), has broken out in Bengal. The writer has seen numerous cases in the Hoogly and Burdwan districts, where the disease has probably been present for the last five or six years. The Palmyra palm itself is not of much economic importance in Bengal, but the writer thinks that there is a great danger of the disease spreading to the valuable coco-nut and areca palms unless the affected material is immediately destroyed by burning the tops of all diseased palms.

WILLAMAN (J. J.) & SANDSTROM (W. M.). **Biochemistry of plant diseases. III. Effect of Sclerotinia cinerea on Plums.**— *Botan. Gaz.*, lxxiii, 4, pp. 287–307, 7 figs., 1922.

In previous papers the senior author dealt with the vitamine requirements and the relation to pectic substances of the brown rot organism of stone fruits, *Sclerotinia cinerea*. The present paper deals with the changes in composition of certain varieties of plums brought about during the process of rotting by this fungus.

Three of the varieties used in the experiments were markedly resistant to *S. cinerea*, while the two others were very susceptible. Samples of each were examined at three stages of growth, namely, when half-grown, when fully grown and just beginning to ripen, and when fully ripe but still on the tree. From each sample a portion was analysed immediately, another inoculated and left to rot in a moist chamber, and a third left without inoculation in a moist chamber for the same length of time as the last. The inoculations were made by injections into the pulp, so as to avoid the factor of mechanical or other resistance of the skin of the fruit.

The susceptible varieties were found to rot more quickly after inoculation than the others (9 to 13 days as against 13 to 18 days according to the stage of growth), and they also showed a more abundant aerial growth of mycelium. The rotted fruit of the resistant varieties was also decidedly firmer in texture than that of the susceptible varieties.

Chemical analyses showed that in most cases the specific gravity of the expressed juice decreased in the sound fruit during storage in the laboratory, and that there was a still further decrease in the rotting fruit. There were indications of varietal differences in juice density which may be correlated with resistance, the resistant varieties having a higher specific gravity than the susceptible, even when the fruit had rotted. In most samples the acidity was less in the rotted than in the sound fruit. The acidity in plums does not fluctuate to any appreciable extent during the ripening process. In the fresh samples the resistant varieties had a somewhat higher acid-content than the susceptible, but no difference was apparent in the stored and rotted samples. There was no conclusive evidence that acidity is an important factor in the resistance of plums to brown rot. The changes in titratable acidity were relatively greater than those in H-ion concentration, the average percentage decrease in the former from sound to rotted samples being 17. This would indicate a consumption of acid by the fungus.

There was a marked increase of tannin during the storage of the sound samples in the first stage of growth but this did not occur when the fruit was infected by the fungus. The tannin-content did not appear to have any bearing on resistance or susceptibility. In all cases there was a small amount of oxalic acid present in the juice of the fresh fruit, and there was usually more in the rotted samples than in the fresh or sound stored ones, which points to a production of oxalic acid during rotting. There were some indications that a high oxalic acid-content denoted resistance to the disease.

Owing to the great irregularity in the quantities of total nitrogen

in the three groups of samples, no clear indications of the nitrogen relations were obtained. There was some evidence that the rotted samples contained a higher proportion of total nitrogen than the sound ones. The fungus converts a portion of the non-protein nitrogen of the host into protein nitrogen in its own mycelium. Nitrites could not be detected in any of the samples, and the disturbance of nitrogen nutrition cannot be a factor in this disease.

It is not yet possible to suggest a hypothesis for the chemical and physiological bases of resistance to the brown rot of stone fruits.

BOAS (F.) & MERKENSCHLAGER (F.). **Versuche über die Anwendung kolloidchemischer Methoden in der Pflanzenpathologie.** [Experiments in the application of colloid-chemical methods in plant pathology.] *Centralbl. für Bakt.* Abt. 2, lv, 21–24, pp. 508–515, 3 figs., 1922.

Modifications in the colloidal properties of the proteins are effected by neutral salts as well as by acids and alkalis. The neutral salts of the alkalis precipitate albumin only at high concentrations, while those of the alkaline earths do so at lower concentrations. The well-known tendency of the lupin (*Lupinus luteus*) to chlorosis when grown on soils rich in lime may be traceable to a direct action of the alkaline earth on the albumin or to denaturization or flocculation of the albumin in the cell on account of the absence of protective colloids. The structure of the cell constituents would be thereby disorganized, numerous active constituents of the protoplasm would be broken down, and the plant would suffer far-reaching damage.

An investigation of the expressed sap of ten to twelve days old seedlings of *Lupinus luteus* showed that the cations of the alkaline earths, especially calcium, produce immediate flocculation of the proteins. Even very small quantities of calcium chloride will produce this effect, magnesium chloride being somewhat less effective, while potassium chloride has practically no action. The calcifuge habit of the lupin is evidently therefore the result of this action of the calcium ion on its peculiarly susceptible proteins. The latter are present in unusually high proportion in comparison with the carbohydrates (45·07 to 10·02, whereas in peas the protein is 23·19 and carbohydrates 53·02).

Viscosity tests were carried out with extracts of the seeds of lupin and pea. Extracted with water the former filtered much more readily than the latter, but when extracted with 5 per cent. sodium chloride the position was reversed. This is due to the fact that conglutin, the albumin of lupin, is very slightly soluble in water but readily soluble in a solution of sodium chloride, while the legumin and vicilin of the pea are appreciably soluble in water and filter at about the same rate whether extracted with water or sodium chloride. When various salts were added in order to test the action of cations on the viscosity, it was found that the pea extract made with sodium chloride was not affected in its rate of filtration by calcium or magnesium chlorides, while that of lupin filtered more rapidly as a result of flocculation of the albumin.

The action of magnesium on the lupin has not usually been

separated from that of calcium, but it is evident that it should be similarly deleterious, and this has already been stated to be the case by several observers. The low proportion of carbohydrate is probably an important factor since it is said to act as a protective substance to the protein bodies. The lupin differs fundamentally from most other plants in its metabolism and it is not suggested that the above explanation of its liability to chlorosis in calcareous soils would apply to other calcifuge plants.

DUCOMET (V.). **Observations et expériences sur les maladies de dégénérescence de la Pomme de terre.** [Observations and experiments in connexion with 'degeneration' diseases of the Potato.]—*Bull. Soc. Path. Vég. de France*, ix, 1, pp. 29–38, 1922.

The author has cultivated 52 lots of the variety Institut de Beauvais from various parts of France, information regarding conditions of soil, altitude, age of stock without renewal, &c., having been obtained in each case. As a result of these tests and inquiries he notes that both leaf roll and 'frisolée' [mosaic] are widespread in this variety in France, the former being, on the whole, the more prevalent. Their onset and subsequent increase has varied in different localities; neither soil conditions, nor altitude, nor long continued cultivation of varieties seems to be an important factor in their intensity, but rather the degree of infection in the seed tubers used. In only one case was leaf roll absent, and in this the plants had frisolée.

Varieties particularly subject to leaf roll are more likely to be attacked by frisolée than vice versa. None of 70 varieties tested at Grignon has proved really immune, though the degree of attack varies greatly. Some are equally susceptible to both diseases, others to one more than to the other. Within a variety perfectly healthy individuals sometimes are found.

These diseases are not the result of cultivation, since the author found that the wild species *Solanum maglia*, *S. commersoni*, and *S. caldasii* became infected at Grignon. The frisolée of *S. commersoni* corresponds with what Berthaut has called the 'mutation frisée' of this species.

At least two forms of leaf roll may be distinguished, the ordinary trumpet-shaped, and a second which is more spoon-shaped. The latter corresponds to the marginal leaf roll of Quanjer. The term frisolée is preferred by the author to mosaic since the leaf mottling implied by the latter word is usually not marked, and when distinct the disease is not true frisolée but the Aucuba mosaic of Quanjer [see this *Review*, i, 8, p. 255]. The old name frisolée dates from the time of Parmentier, and describes the usual undulated and goffered appearance of the leaves of diseased plants from the first period of attack, long before the 'curly dwarf' stage is reached. A form characterized by non-crinkled leaves, marked by ill-defined local discoloration, is possibly a distinct disease, and if so the term mosaic would be better applied to it.

Rain may cause leaf roll to disappear temporarily, but this is not the case with frisolée, which is generally more marked in wet weather, the curly dwarf form excepted.

The author has failed to confirm Quanjer's statement that in the first year leaf roll is marked by symptoms confined to the top of the plant. The leaf rolling has always appeared to him to commence towards the base. He states that Quanjer himself appears disposed to abandon his former distinction between primary and secondary leaf roll. The three true symptoms of leaf roll are the rolling and hardness of the leaves, the interference with translocation of starch, and phloem-necrosis. The accumulation of starch precedes the leaf rolling, and this in its turn precedes phloem-necrosis. Hence the primary cause acts by disturbing diastatic activity; there is hypernutrition leading to premature maturation of the leaves.

The diseases may not be as entirely systemic as is generally believed. Tubers from a diseased plant have been cut in half and the halves have given a diseased and a healthy plant respectively. So also healthy shoots are sometimes found in diseased plants, and even axillary shoots from the same shoot may show some diseased and some healthy. Transmission through the seed is usually stated not to occur, but the author's seedlings of certain varieties have been so heavily attacked, even when he could find no green fly, that he is forced to conclude either that the diseases (especially frisolée) are hereditary, or else that there is a very marked hereditary predisposition to them.

ARTSCHWAGER (E.). **Occurrence of phloem necrosis in leaf roll tubers.**—*Phytopath.*, xii, 4, pp. 193-194, 1922.

The writer has recently observed a wide distribution of phloem-necrosis in the stolons and tubers of potato plants affected by leaf roll. Plants of long leaf roll lineage show signs of necrosis in the stolon even before the new tubers have attained an appreciable size. The diseased groups commonly found in the inner cycle show progressive lignification and the severity of necrosis increases with age. Mature tubers are often borne on stolons, the phloem tissue of which is completely diseased; in the tuber itself, however, the advance of necrosis is slow, being confined primarily to the basal region. If tubers slightly affected with phloem-necrosis are used for seed, it will be found that the malady becomes greatly intensified in the seed tuber when the plants have reached an appreciable size, and seed pieces from lateral and terminal eyes which showed no necrosis before planting will have developed it at this stage.

Experiments conducted with whole and cut tubers to determine the relative development of necrosis in the seed pieces after the latter were planted showed that necrosis developed only in vascular tuber tissue connecting with actively growing sprouts, the phloem tissue in the region of the dormant buds being normal. Thus the development of necrosis in the seed piece is undoubtedly correlated with growth activities and the movement of food initiated in the sprouting eye. There is an increase in vascular tissue to accommodate the increased transfer of food substances. The relative severity of necrosis in stolons and tubers, and the earliness of its development appear to be an index to the length of existence of the disease in a tuber line.

HUNGERFORD (C. W.). **Leaf roll, mosaic, and certain other related diseases in Idaho.**—*Phytopath.*, xii, 3, pp. 133–139, 1 pl., 1922.

Leaf roll and mosaic appear to be on the increase in potatoes in Idaho. The mottling, in the case of mosaic, may not be evident in the field, but was found to appear under greenhouse conditions Field tests gave a marked decrease in the yield from crops grown from tubers of plants affected with leaf roll or mosaic. The author also describes more fully the disease which he had previously (*Proc. Wash. Hort. Assoc., 1920*, p. 266) named russet dwarf. Affected plants in the field resemble somewhat those affected with mosaic, and are smaller and lighter in colour than normal plants. The leaves, especially the lower ones, have a rusty appearance, the veins on the lower surface appearing first water-soaked, then turning brown. Later on these lower leaves may fall off progressively from the ground up. Dark brown streaks are present on the petioles and stems of the lower part of the plant. The disease is transmitted by the tubers, and when tubers are planted in the greenhouse the symptoms are striking. The disease is also evidently transmitted from plant to plant in the field. Its cause has not been determined.

Another condition, termed calico, is fairly common in irrigated sections of Idaho, Washington, and Utah. The leaves are variegated, sometimes as much as half the surface being almost completely chlorotic, although later these areas may develop chlorophyll. Otherwise the plants appear normal, and the yield is not materially reduced. Tubers from affected plants transmit the condition.

EYER (J. R.). **Notes on the etiology and specificity of the Potato tip burn produced by Empoasca mali Le Baron.**—*Phytopath.*, xii, 4, pp. 181–184, 1 fig., 1 pl., 1922.

Recent investigators consider that tip burn of potato is either of a physiological nature or caused by the feeding of the potato leaf hopper (*Empoasca mali*). Ball (*Wisconsin Dept. of Agric. Bull.* 23, 1919) concluded that some 'specific' was transmitted by the insect, and this circulating through the veins caused the death of the tissue supplied by them.

The object of the experiments described here was to determine the nature and transmissibility of the 'specific' injected. Inocula were prepared by macerating the nymphal and adult stages of the insect in sterile water or alcohol, and were forced into the leaf tissues through the midrib, injections into the leaf membrane giving no results. The inoculated plants were placed in direct sunlight, and all developed typical tip burn in twenty days in the open, the progress of the disease being slower (twenty-eight days) if the plants were kept under glass. The disease develops naturally (i. e. when caused by the feeding of the leaf hoppers) within 4 days of inoculation. All the check plants remained healthy. Inocula prepared from the nymphs produced tip burn more quickly than those of adults. The 'specific' of tip burn exists in diseased leaf tissue after infection by the leaf hopper, and may be transmitted to healthy plants by inoculating them with an alcoholic extract of diseased leaves. Inoculations with extracts of various other insects which normally feed on the potato, gave negative results with the excep-

tion of *Nysius ericae* Schill, which caused chlorosis and death of the tissues but not tip burn. Mechanical injury to the midrib sometimes resulted in a browning similar to tip burn, but this did not spread beyond the group of cells injured.

BARRUS (M. F.) & CHUPP (C. C.). **Yellow dwarf of Potatoes.**—*Phytopath.*, xii, 3, pp. 123-132, 2 pl., 1922.

This disease, which is probably a new one, has appeared in various parts of New York State. Eighteen varieties have been found affected, and none of these seemed to show resistance. The plants have a stocky, dwarfed appearance, and the stems are yellowish-green in colour. The growing apex dies early. The stems when split show rusty specks in the pith and cortex of the nodes, and sometimes also of the internodes, of the upper portion of the plant. The leaflets are generally rolled, but sometimes corrugated. The most characteristic symptoms are shown by the tubers. These are usually small, few, set close to the stem, and sometimes cracked. The flesh is often discoloured with rusty brown specks or areas in the pith and other internal tissues of the tuber, but this discoloration is seldom found in the fibro-vascular bundles. These discoloured areas are most pronounced in the middle or bud end of the potato as taken from the field, the stem end not being affected except during storage. The old seed piece is usually intact during the growing season.

The authors found evidence that the causal agent exists, or persists, in the soil over winter. The disease may perhaps be carried also by the seed, but usually when affected tubers were planted they produced either no plants or only dwarfed and spindly ones. The causal agent has not been determined.

FRANCHINI (G.). **Amibes et autres protozoaires de plantes à latex du Muséum de Paris.** [Amoebae and other protozoa of latex-bearing plants at the Paris Museum.]—*Bull. Soc. Path. exot.*, xv, 4, pp. 197-203, 1922.

In this paper the author describes the protozoa found in latex-bearing plants other than those previously recorded [see this *Review*, i, 9, pp. 307-312.]

EUPHORBIACEAE. Trypanosomes frequent in *Elaeophorbia drupifera*; less frequent in *E. calyculata*. These trypanosomes strongly resemble those found in the latex of *E. nereifolia* and *E. virosa* in Italy, except for their smaller dimensions and rounded instead of rod-shaped blepharoplasts. The flagellum was usually absent. U-shapes were frequent, and there were a few forms with two nuclei and a centrosome. In the latex of *Excoecaria emarginata* trypanosomes were frequently observed, the dimensions of which generally exceeded those of the foregoing. U-shapes were somewhat rare, and the latex also contained large bodies measuring 10 to 15 by 3·5 to 4 μ with several masses of chromatin in the protoplasm. These were probably stages of reproduction. Other forms showing a large vacuole in the centre were probably degenerating. Slow but distinct amoeboid movements were observed. *Euphorbia verticillata* contained no trypanosomes, but a few amoebae were present, measuring 10 to 12 μ, and having one or more masses of

chromatin in the protoplasm. The latex of *Manihot dichotoma* contained small bodies similar to *Leishmania*.

ASCLEPIADACEAE. *Chlorocodon whitei* was infested by small amoebae, and *Cryptostegia grandiflora* by numerous amoebae of different species and varying dimensions, and occasional crithidian forms.

APOCYNACEAE. Amoebae were frequent in the latex of four species of *Strophanthus*, in *Acokanthera*, *Thevetia*, and *Cerbera odollam*. The last-named contained infrequent *Herpetomonas*. The amoebae contained in the latex of Apocynaceae had a dense protoplasm with few vacuoles. The nuclei varied in number from one to eight or more.

MORACEAE. *Cudrania javanensis* contained numerous protozoa with marked amoeboid movements. There were one or two nuclei in the protoplasm and a dark, comma-shaped centrosome. The plant was in poor condition, yellow, and with a scarcity of latex. Amoebae and other protozoa were observed in the latex of *Ficus benjamina*, *F. pierrei*, *F. tholloni* (partially withered), and *F. carica*. The last-named were outdoor fig trees, examined in March, which suggests that the organisms can survive the winter. Amoebae were frequent in *Antiaris toxicaria* and *Artocarpus lakoocha*.

SAPOTACEAE. *Chrysophyllum*, *Labramia bojeri*, *Treculia africana*, and various species of *Mimusops* were the most heavily infested. The amoebae resembled those present in the latex of *Antiaris* and *Artocarpus*. Flagellates of the *Herpetomonas* type were observed in the latex of *Sideroxylon inerme*. Spherical or oval protozoa were seen in *Mimusops schimperi*, with a long flagellum 10 to 15 μ in length, and containing several chromatin masses. *Chrysophyllum glabrum* and another species of *Chrysophyllum* contained large trypanosomes resembling those of *Cudrania javanensis*.

MENISPERMACEAE. Small, spherical or oval bodies were present in *Stephania rotunda* var. *succirubra*.

ANACARDIACEAE. A small protozoon, usually spherical, with one or more nuclei, was observed in *Oenocarpus vitiensis*.

Some of these plants, especially those most heavily infested, were yellow and contained little latex. The mean temperature of the plant-houses in which they grew was 23° C.

Cultures of the amoebae were obtained on a solid medium containing blood. They are undoubtedly new species of which this is believed to be the first record.

BISBY (G. R.), CLAYTON (E. E.), MARTIN (W. H.), ROSA (J. T. Jr.), & STOKDYK (E. A.). **The co-operative Potato spraying project. Report for 1921.**—*Phytopath.*, xii, 5, pp. 241–248, 1922.

Intended to supplement the data already published [see this *Review* i, 2, p. 36], the present report brings the results of potato spraying and dusting experiments up to date. It appears that Ohio and Manitoba may be added to the list of regions where the use of Bordeaux for potatoes is profitable. These and additional data from New Jersey, West Virginia, Pennsylvania, and elsewhere, together with published results for Canada, gave further indications of the value of spraying even in the absence of *Phytophthora*. In

Kansas and Missouri the advantage of Bordeaux spraying is questionable, although in 1921 increased yields were obtained in each case. Further particulars as to the mode of application, technique, &c., are included in this report.

During 1921 dusting tests on potatoes in New Jersey, Ohio, and Manitoba gave results inferior to those obtained by spraying. This inferiority of dust may be partly due to the dry season and the absence of late blight [*Phytophthora infestans*] in the areas in question.

KLEBAHN (H.). **Wirtswechsel und Spezialisierung des Stachelbeerrostes.** [Heteroecism and specialization of Gooseberry rust.]—*Ber. deutsch. bot. Gesellsch.*, xl, 3, pp. 104–111, 1922.

Eriksson (*Arkiv för Bot.*, xvi, 1920) has called into question Klebahn's view relative to the biologic specialization of the *Carex* rusts with aecidia on *Ribes* and *Urtica*. The present article deals with an attempt on the part of Eriksson to demonstrate the existence of an intermediate form, which he calls *Puccinia caricis* f. *diffusa*, on the ground that in twelve out of fifty-two cases of inoculation with teleutospores from *Carex*, infection occurred both in *Urtica* and *Ribes grossularia*, and in thirty-five on *Urtica* alone. The author thinks that this can be explained by an accidental mixture of the spore material, and states that, after renewed experiments, he maintains his opinion that the rusts forming aecidia on *Ribes* and *Urtica* are biologically distinct.

RAWITSCHER (F.). **Beiträge zur Kenntnis von Ustilagineen. II.** [Contributions towards a knowledge of Ustilaginaceae. II.]—*Zeitschr. für Botanik*, xiv, 4, pp. 273–296, 2 figs., 2 pl., 1922.

The author states that the first nuclear divisions during the germination of the spores of *Tilletia tritici* take place within the spore and not in the promycelium as described by Paravicini and by Dastur [see this *Review*, i, 3, p. 88]. The process, which is fully described, results in the formation of four (? haploid) nuclei which seem to have two chromosomes, the diploid nucleus having apparently four chromosomes. By the third day most spores contain eight nuclei which are still dividing, so that when the promycelium appears on the third or fourth day up to sixteen nuclei may migrate into it. No divisions were observed to take place in the promycelium.

In *Cintractia montagnei* the first nuclear divisions occur in the promycelium as it is formed. The resulting four nuclei may be distributed in either of two different ways: if like nuclei are in the two upper cells of the promycelium, a process is put out which connects the terminal and basal cells while the second and third cells are united by a clamp-connexion; if the two types of nuclei alternate in the four cells, the two distal cells and the two basal ones are united by clamp-connexions.

Urocystis violae behaves like *U. anemones* as described by Kniep [see this *Review*, i, 3, p. 86], except that it usually produces 8 (sometimes 7) primary, and 4 secondary, 4-nucleate sporidia.

In *Doassansia sagittariae* there is no fusion of sporidia. Secondary, tertiary, and subsequently formed sporidia are all uninucleate,

as are also the infecting hyphae. The paired-nuclei stage appears shortly before the formation of spores. The two nuclei fuse in the young spore.

The author notes that nuclear fusions have been found in all the smuts so far investigated but the process differs widely in different species. If the fusion of nuclei derived from the same fusion-nucleus denotes a retrogression in sexuality, the degree of this retrogression varies. In the *Tilletiaceae* conjugation of sporidia from the same promycelium seems to be the rule and it is constant in species of *Urocystis* and in *Doassansia alismatis*. In *Ustilago*, however, sporidia from different promycelia may conjugate, although in no case, so far as is known, is this obligatory.

The reduction divisions take place at the time of germination of the spore but the haploid stage varies greatly in length, the extremes being cases such as *Ustilago maydis* and *Doassansia sagittariae*, where almost the whole vegetative life is haploid, on the one hand, and *Urocystis anemones*, which forms only four haploid cells, on the other.

La Rue (C. D.). **The results of selection within pure lines of Pestalozzia guepini Desm.**—*Genetics*, vii, 2, pp. 142-201, 10 figs., 1922.

The author has carried out an investigation of the effects of selection within pure vegetative lines on *Pestalozzia guepini* Desm. This fungus was selected because of the presence of numerous distinct strains within the species [see above, p. 413]; the ease with which it can be grown in culture; the rapidity with which consecutive generations are produced; the availability of at least two easily measurable independent characters (length of spore and length of appendages); the rapidity with which spores are produced and their enormous numbers; the dark colour of the central cells of the spores, which develops only at maturity and serves to eliminate mere growth stages; and the total absence of any sexual form of reproduction.

The cultures were kept under as constant conditions as possible in ordinary laboratory (not incubator) conditions in Sumatra, and were started from single spores of the strain studied. From this strain twenty single-spore cultures were made to provide material for selection. Measurements were made on 100 spores of each culture. The culture giving the greatest mean spore length was taken for plus selection, and that with least spore length for minus selection. A third culture, as near as possible midway between the two, was taken as an intermediate to be carried on without selection. From the plus and minus cultures ten single-spore cultures were made and again 100 spores were measured from each of these ten cultures, those giving the greatest and least spore lengths being taken for continued selection. The process was repeated through ten generations. The same procedure was followed for length of spore appendages, except that the selection was carried through twenty-five successive generations.

In neither case was any evidence obtained that selection had been effective in increasing or diminishing the two measured characters. In one case a mutation was observed, giving a greater

length of spore appendages than any other met with in the whole series, and differing also in other spore characters. This mutation has remained constant for several generations and will be further studied.

Another set of experiments, in which selection was made by direct measurement of the spore length of the single spore taken to start the culture in each generation, gave similar results.

A discussion is added in which the results of other workers on similar lines are critically examined.

SACCARDO'S **Sylloge Fungorum.**

In a circular received from Prof. L. Montemartini, Director of the Cryptogamic Laboratory, Botanical Institute, Royal University of Pavia, Italy, it is stated that two volumes of the *Sylloge*, which were in preparation by Saccardo at the time of his death, are being completed by Traverso and Trotter and will contain the descriptions of fungi published between the years 1912 and 1917.

The further continuation of this great work has now been undertaken by the Cryptogamic Laboratory at Pavia and Dr. Montemartini asks that all information on mycology published after 1917 may be sent to the Laboratorio Crittogamico, R. Università di Pavia, Italy.

Mycologists throughout the world will be glad to know that the future of the *Sylloge* is assured and has been placed in such competent hands.

LAIBACH (F.). **Untersuchungen über einige Ramularia- und Ovularia-Arten und ihre Beziehungen zur Askomyzetengattung Mycosphaerella. II. Ovularia obliqua (Cooke) Oudem.** [Investigations of certain species of *Ramularia* and *Ovularia* and their relations to the Ascomycete genus *Mycosphaerella*. II. *Ovularia obliqua* (Cooke) Oudem.]—*Centralbl. für Bakt.*, Abt. 2, lv, 11–13, pp. 284–293, 6 figs., 1921.

The genus *Ovularia* closely resembles *Ramularia*, the chief difference being that its conidia are continuous. The author has succeeded in establishing that *Ovularia obliqua* has for its perfect stage a *Mycosphaerella* similar in many respects to the *Mycosphaerellas* which have *Ramularia* conidia. The fungus is common in its conidial form on many species of *Rumex* and the perithecial stage has been found on the under side of the *Ovularia* spots on fallen leaves of the previous year.

The conidia are formed singly at the tips of conidiophores which emerge in bundles through the stomata of the leaf. The conidiophore continues to grow, pushing the first conidium over to one side and forming a second one at the tip some distance further on. Spore chains are never formed. The perithecia are of the usual *Mycosphaerella* type, and like those of *Ramularia knautiae* give rise to a copious growth of conidiophores and conidia from their walls when placed in a moist atmosphere. Pure cultures of the ascospores gave rise to the *Ovularia* form and inoculations with ascopores on *Rumex obtusifolius* caused typical spots to appear, which subsequently bore conidia.

The author separates species of *Mycosphaerella* with a conidial

stage belonging to the *Ovularia* type as a new genus *Ovosphaerella*, and names the present species *O. lapathi*. This is a further addition to the genera which he has previously [*Centralbl. für Bakt.*, Abt. 2, liii, p. 559, 1921] separated from the old genus *Mycosphaerella*.

BROOKS (R. St. J.). **The National Collection of Type Cultures.**— *Trans. Brit. Mycol. Soc.*, vii, 4, pp. 237–239, 1922.

Early in 1921 the Medical Research Council made arrangements, by the courtesy of the Governing Body of the Lister Institute of Preventive Medicine in London, to maintain a National Collection of Type Cultures at the Institute. Since the formation of the Collection some 1,200 strains of micro-organisms, chiefly bacteria, of medical, veterinary, and economic importance have been incorporated in the collection, and cultures have been distributed to workers at home and abroad at the rate of about 2,000 per annum. A catalogue of all the strains is being printed, and is expected to be available for distribution shortly. The Staff are prepared to give assistance in the identification and classification of strains sent in by correspondents.

During the early part of the current year it was proposed to extend the scope of the National Collection by including representative fungi derived from different sources, as the need of a Mycological Collection in this country had long been felt. The British Mycological Society were asked to appoint a fully representative standing committee to advise and assist in all questions appertaining to fungi, and this has been done. The scope of the Mycological Collection includes the collection and maintenance of cultures of fungi of importance in phytopathology, medicine, veterinary science, technology, and soil biology, types useful for teaching purposes, and interesting species. For the present the collection is restricted to fully identified species of fungi, and in sending these it should be stated by whom they were named, and also whether a special medium is required for their growth. Cultures will be supplied on demand, so far as possible, to workers at home and abroad and, as a rule, a small charge will be made to defray the cost of the media and postage. Annual lists of the fungi in the collection will be published in the *Transactions of the British Mycological Society*. A set of type slides of fungi will be kept in the Botanical Department of the British Museum (Natural History), in addition to a working set at the Lister Institute.

SAWADA (K.). **Can Exobasidium vexans Mass. bear conidia besides the basidiospores?** Reprinted from *Trans. Nat. Hist. Soc. Formosa*, lix, 7 pp., 1922.

Blister blight of tea, which has long been prevalent in the Indian tea plantations, is also found in those of Formosa and Japan, especially in the prefectures of Taihoku, Toen, Shinchiku, and Nanto. The most serious damage occurs in March and April, though the disease is present all the year round. A similar disease, caused by an allied fungus *Exobasidium reticulatum* Ito & Saw., is also widely distributed in Formosa, and was formerly confused with *E. vexans*. In 1911 Kawakami [*Formosan Agric. Rev.*, xxxviii, 1911 (Japanese)] reported the results of an investigation of blister

blight in Shinchiku, where the tea plants appear to be exceedingly susceptible to this disease, and in 1912 and 1915 the author's own work on the tea diseases of Formosa was published [*Formosan Agric. Rev.*, lxx, 1912 (Japanese) and *Special Bull. Agric. Exper. Stat. Govt. of Formosa*, xi, 1915 (Japanese)].

The symptoms of the disease on Formosan specimens exactly resemble those described by Indian authors. The present writer believes, however, that the so-called conidia borne on the convex under surface of the blistered area are really bicellular basidiospores. He has failed to find any spores on the tips of simple condiophores as described by Massee and McRae. On following out the development of the basidiospores he found that the unicellular spores borne on the basidium may fall from the sterigmata when ripe or may remain attached until the basidia wither and collapse: in either case they ultimately develop a septum. The differences in measurement obtained by Massee were probably due to his having measured immature basidiospores as well as old bicellular ones. Similar conditions are found in *Exobasidium reticulatum* and *E. machili*, and the author is not satisfied that true conidia occur in any species of *Exobasidium*.

PRITCHARD (F. J.) & PORTE (W. S.). **Isaria rot of Tomato fruits.**—*Phytopath.*, xii, 4, pp. 167–172, 1 fig., 1 pl., 1922.

During the years 1919–21 a new rot of tomatoes has been observed in the vicinity of Washington, D. C. and Arlington, Virginia. The affected fruits are partly covered by a white, cottony, surface growth, which later becomes pink or pale orange and granular. The surface filaments are sometimes quite coarse and occasionally greenish-yellow in colour, but in a dry atmosphere they are inconspicuous or even absent. The fungus only infects fruits, which may be either green or ripe, and which need not be wounded. It penetrates all the tissues which, however, remain rather firm. The rot is caused by a hitherto undescribed species of *Isaria*, which is named *I. clonostachoides*. A large number of inoculation experiments were made and successful infections obtained in 40 to 90 per cent. The optimum temperature for infection is about 29° C. The morphology and cultural characters of the fungus are described.

List of specimens in the Mycological Herbarium.—*Agric. Res. Inst., Pusa*, May 1921 [1922].

This list, which is primarily intended for the convenience and assistance of mycological officers in the various departments of agriculture in India, is divided into two sections, a fungus and a host index. The former includes a column for the locality in which the fungus was collected. No attempt is made to decide critical points of nomenclature. Supplementary lists of new specimens added to the herbarium will be printed from time to time.

EASTHAM (J. W.). **White pine blister-rust in British Columbia.**—*Agric. Journ. Brit. Columbia*, vii, 2, pp. 29 and 41, 1922.

The presence of white pine blister rust (*Cronartium ribicola*) was first detected in British Columbia in September 1921. Investigation showed that the disease was present on cultivated black

currants over a considerable area in the Lower Fraser Valley and in Vancouver Island.

The disease is described in detail and a short account given of its origin and geographical distribution.

Proect de lege pentru controlul semintelor, combaterea plantelor parazitare in agricultură și incursjarea productiunii de seminte. [Bill introduced in Parliament for seed control, for the suppression of parasitic plants in agriculture and the encouragement of seed production.]—*Buletinul Agriculturii* [Bucharest], i, 1-6, pp. 45–55, 1921. [French Summary.]

All persons in Roumania desirous of trading in seed of lucerne, clover, grass, and other fodder plants, vegetables, drug plants, fruit and ornamental trees, &c., must obtain a licence from the Ministry of Agriculture. Samples of all seeds must be tested at one of the agronomic stations of the country before being placed on the market. The importation of lucerne, clover, timothy, and flax seed containing *Cuscuta*, *Orobanche*, or other injurious parasitic plants is prohibited. Seed produced in the country is subject to testing in exactly the same way as imported seed.

Décret du 26 Janvier 1922 concernant la lutte contre les parasites végétaux et animaux des plantes cultivées, dans la Régence de Tunis. [Decree of 26th January, 1922, concerning the control of vegetable and animal parasites of cultivated plants in the Regency of Tunis.]—*Journ. offic. tunisien*, xx, 11th March, 1922. [Abs. in *Bull. mens. des Renseignements agricoles et des Maladies des Plantes*, xiii, 5–6, pp. 809–810, 1922.]

When the damage caused to cultivated plants by any vegetable or animal parasites assumes, or appears likely to assume, the dimensions of an epidemic or disaster, the Director-General of Agriculture, Commerce, and Colonization shall proclaim the affected areas and define the necessary measures for destruction and for regulation of the transport of plants or parts of plants liable to propagate the parasites in question.

All owners—the State, parishes, and public administrative bodies included—or occupiers, in whatever capacity, of urban or rural landed property are obliged to carry out the rules laid down in the above-mentioned orders. Co-operative protection societies may be formed under certain conditions for the execution of the prescribed measures of control.

In cases where the owners or occupiers fail to conform to the regulations in force, the work of destruction shall be officially carried out at their expense. Responsibility for infringement of the rules laid down for the transport of plants falls equally on the sender and conveyor. Plants fraudulently transported will be seized and destroyed, together with their packings. If they have been planted they will be uprooted and destroyed at the expense of the consignee, who is liable to the same penalties as the sender and conveyor.

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